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FIRE HANDBOOK

[Region Seven]



UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE ~ ~ ~ June, 1931

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UNITED STATES DEPARTMENT *of* AGRICULTURE
FOREST SERVICE

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FIRE HANDBOOK

[Region Seven]

~

June, 1931



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1931

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UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
EASTERN REGION

O-FIRE, HANDBOOK

WASHINGTON, D. C.,

June 1, 1931.

INTRODUCTION

This revision which has been prepared by Supervisor M. A. Mattoon of Pisgah National Forest, will not be final since the work of fire control never remains static. Improved methods and technique will be developed. Policies will change. Standards and minimum requirements will be altered or discarded, and new ones substituted. Progress all along the line will be made. For these reasons the contents will have to be revised from time to time.

There is not much that is new in this revision of the work done by the rangers and supervisors in 1925. The chief changes are in the form of presentation. With the development of the Fire Code in 1926, tried and tested for three years, there was offered an excellent skeleton or framework upon which to rebuild the information at hand. The job of revision was tackled from this standpoint. It is believed that the usability of the handbook has been bettered thereby.

As formerly, the work is divided into three main parts: Prevention, Preparedness, and Suppression. Each of these parts is subdivided into chapters dealing in logical sequence with the fire-control job. Each chapter is prefaced by a short foreword sketching the contents briefly and giving the high lights. At appropriate points through the text principles of the Fire Code are quoted, and such quotations are set off so as to interfere as little as possible with the easy reading of the text. A summary of code principles for each of the three parts appears at its beginning.

An effort has been made to keep the revision from being a mere elaboration of the Fire Code or a thesis on fire control. It is hoped that there is meat in it to sustain us in the never-ending job of keeping fire out of the national forests of the East and South.

In revising the handbook, acknowledgement is made by Supervisor Mattoon for the constructive criticism and assistance rendered by other supervisors and regional office members.

JOSEPH C. KIRCHER,

Regional Forester.

PART I.—PREVENTION

THE FIRE CODE

Principles

1. POSSESSION OF EXACT AND DETAILED KNOWLEDGE OF EACH RISK, gained by comprehensive risk surveys embracing causes of past fires, mental attitudes, customs and motives of local residents and other forest users, physical situations, and seasonal use and occupancy. (*New areas mean new dangers.*)
2. Determination and clean-cut definition of each risk zone.
3. Preparation of PLANS providing specific lines of action to ward off, overcome, or minimize each risk within each zone.
4. Timely, diligent, and effective EXECUTION OF PLANS.
5. CONSTANT VIGILANCE after plans are drafted to sense, identify, and cope with new risks, shifting risks, and enlarged risks.
6. PROVISION FOR PROMPT SHIFT OF MEN to new duties, new positions, or the EMPLOYMENT OF EMERGENCY GUARDS as risks shift or enlarge or as new risks develop.
7. TRAINING OF FORCES in survey and identification of risks, public contacts, control of specific risks, reduction of inflammability, and law enforcement.
8. APPLICATION OF CREATIVE THOUGHT, foresight, and alertness in sensing opportunities and providing needed facilities for current and future prevention programs.
9. PARTICIPATION in the state-wide field of forest-fire prevention, the demands of local fire problems and other Forest Service work being given due priority.

A FIRE PREVENTED IS NO FIRE AT ALL

PRIORITY

As an activity the prevention of fire in the national forests of the East and South has priority over all other activities. As a job it is second only to fire suppression.

RESPONSIBILITY

The regional forester is required to contribute a definite and aggressive leadership and the necessary sinews of war in the regional battle to eliminate man-caused fires.

The supervisor will direct and participate in the fire-prevention program of his forest.

The district ranger must meet the prevention requirements of the Fire Code within his district, and he justly looks to the supervisor for leadership, guidance, and support in this task. He will direct the prevention activities of his guards.

PERSONAL ACCOUNTABILITY

Every forest officer will take an active individual part in fire prevention. His value as an employee may be determined very largely by his energy, his methods, and the results he obtains on the job of fire prevention. Failures to assume responsibility for and participate in necessary fire-prevention activities within his scope of action will be a basis for appropriate personnel action.

CHAPTER I

SURVEY OF THE SITUATION

The survey of the situation involves the following:

1. Analysis of risks.
2. Record of physical dangers.
3. Development of the methods and technique required to minimize each definite risk or physical danger translated into plans of action.

During the 10-year period 1919 to 1928, inclusive, 96 out of every 100 fires were man caused. Practically no land was burned over by the four lightning fires out of this same 100. Practically the same situation obtains to-day. Keeping in mind these facts it will be realized why so much emphasis is laid on the need for fire prevention. Given control of the human problem through fact-finding analysis and result-getting treatment, the starting of forest fires will be reduced to a minimum.

Fire prevention that gets away from the scatter-gun methods and broad generalities must develop beyond its present good start. The value of conventional attempts to eliminate the woods burner and local and regional carelessness are not deprecated except where and as this method of approach is proposed and used as a substitute for more definite nail-driving means directed at specific risks under definite sets of circumstances and conditions. The general approach—that is, the use of fire posters, slogans, newspaper articles, civic club speeches, etc.—has its place, but this form of education reaches only indirectly the people who actually set the fires in the eastern national forests.

Such forms of education help. They register with the broad public and contribute to the upbuilding of a general forestry consciousness. Broad public opinion exerts some influence locally; however, it is not sufficiently potent. The fire-prevention job here requires more. It calls for methods that isolate each risk and prescribe and administer definite remedies in each case systematically and scientifically.

ANALYSIS OF RISKS

PRINCIPLE 1: Possession of exact and detailed knowledge of each risk, gained by comprehensive risk surveys embracing causes of past fires, mental attitudes, customs and motives of local residents and other forest users, physical situations, and seasonal use and occupancy. (*New areas mean new dangers.*)

Risk surveys.—The first step is the Analysis of Risks that digs to the bottom of every cause. We must know how to make analyses, how to identify definite risk zones, how to map them and how to gain a keener perception generally into this phase of fire prevention. The development of sheet B of the Fire Statistical Series and the outlining of its purpose provide a needed and convenient mechanical aid for making risk analyses and a canvas for painting a clearer and sharper picture of fire-risk factors. Administrative officers who have given careful thought to the value of fire-risk analyses clearly understand the methods to be employed and the objects sought. It is up to them to carry on.

The human risks for each forest and for each ranger district will be determined and catalogued. The best indicator of specific human risks and a good starting point for determination of kinds and locations of such risks is an analysis embracing the location and causes of past fires. It will usually be found that risks naturally fall into more or less well defined zones. These zones are usually determined by certain local customs, mental attitudes, physical conditions, or the seasonal use and occupancy of these areas. Incendiarism is quite often confined to well delineated areas. Local

customs of brush burning, tobacco bed burning, burning the range, fall hunting or spring fishing, camping, etc., are susceptible of analysis and study. Only by going over the ranger district with a fine-tooth comb, studying, analyzing, and cataloguing its physical situations, its seasonal use and occupaney, and the attitudes of mind of the people residing on or near, or passing through the district, can a complete picture of the human risk be secured. The study of past conditions as shown by the statistics (notably sheet B and cumulative fire map) brought down to to-day's situation embracing recent changes in population, acquisition of new areas with their attendant new risks, and the difficult but altogether possible determination of very local mental attitudes, is absolutely necessary to form the solid basis for effective action looking toward reduction of each risk. In other words, it is the taking to pieces of the ranger district, watershed by watershed, and the local people, group by group, or if necessary, by individuals, studying, analyzing, and classifying, basing information on facts and not fancy or theory, getting at the seats of trouble, and putting all the information down in written or graphic form for use in prescribing curative action.

PRINCIPLE 2: Determination and clean-cut definition of each risk zone.

Zones of human risk.—Accurately classified risks will be shown graphically in zones on the risk-zone map.

Risk zones will be completely described with special reference to the human element residing or being in each zone. The intelligent use of the contact record will be of material assistance in segregating woods burners. Each risk zone or portion thereof will be further designated as: *a.* High; *b.* medium; or *c.* normal, which are defined as follows:

a. High: Regions where known antagonism to fire prevention exists which may be from any of the following sources:

Burning for range.

Burning to kill bean beetles and cotton boll weevils.

Burning for a job fighting fire.
Burning to clear up woods.
Burning to improve huckleberries.
Burning through lawlessness.
"Moonshiners" and their customers.

There are others. (See Check List Special Human Risks, pp. 89-91, inclusive, of the appendix.)

b. Medium: Regions not entirely antagonistic, but rather indifferent. People who see no harm in woods burning; careless, thoughtless, misinformed inhabitants; brush burners; recreational centers.

c. Normal or low: Regions where fire prevention has become a part of the public consciousness, but where individuals are inert and willing to "Let George do it."

A complete survey for each ranger district will be made by the district ranger with necessary assistance from the supervisor and currently revised and kept up to date.

2. RECORD OF PHYSICAL DANGER

In addition to classifying and cataloguing zones of human risk it is necessary to take cognizance of special zones of physical danger, such as unburned railroad rights-of-way, areas of heavy slash, areas of especially high inflammability, windfalls, blight or beetle killed patches, or any other conditions which tend to increase the hazard or the difficulties of suppression. Such areas must be carefully mapped and considered for special treatment.

3. DEVELOPMENT OF METHODS AND TECHNIQUE REQUIRED TO MINIMIZE EACH DEFINITE RISK OR PHYSICAL DANGER

PRINCIPLE 3: Preparation of plans providing specific lines of action to ward off, overcome, or minimize each risk within each zone.

The definite steps which are to be taken to ward off, overcome, or minimize each risk must be clearly set forth in the local plans of work. They will be worked out by the district ranger with the help and

advice of the supervisor and currently kept up to date through revision made necessary by current changes on the district.

The specified action will be direct, detailed, and specifically designed to combat each particular risk whether it be of human risk or the reduction of a physical danger. The orderly dispatch of jobs will be carried over into plans of work. A check list of suggested action directed at common risks is on pages 91-94, inclusive, of the appendix.

EXHIBIT 10 - SUMMARY OF THE APPENDICES

Appendix 10 is a summary of the appendices to the report. It lists the titles of the appendices and the pages on which they are found. It also lists the titles of the appendices which are not included in the report, but which are available in the original documents. The appendices are as follows:

Appendix 1 - Summary of the report. This appendix is a summary of the report, and is included in the report. It lists the titles of the appendices and the pages on which they are found. It also lists the titles of the appendices which are not included in the report, but which are available in the original documents.

Appendix 2 - Summary of the report. This appendix is a summary of the report, and is included in the report. It lists the titles of the appendices and the pages on which they are found. It also lists the titles of the appendices which are not included in the report, but which are available in the original documents.

Appendix 3 - Summary of the report. This appendix is a summary of the report, and is included in the report. It lists the titles of the appendices and the pages on which they are found. It also lists the titles of the appendices which are not included in the report, but which are available in the original documents.

Appendix 4 - Summary of the report. This appendix is a summary of the report, and is included in the report. It lists the titles of the appendices and the pages on which they are found. It also lists the titles of the appendices which are not included in the report, but which are available in the original documents.

Appendix 5 - Summary of the report. This appendix is a summary of the report, and is included in the report. It lists the titles of the appendices and the pages on which they are found. It also lists the titles of the appendices which are not included in the report, but which are available in the original documents.

Appendix 6 - Summary of the report. This appendix is a summary of the report, and is included in the report. It lists the titles of the appendices and the pages on which they are found. It also lists the titles of the appendices which are not included in the report, but which are available in the original documents.

Appendix 7 - Summary of the report. This appendix is a summary of the report, and is included in the report. It lists the titles of the appendices and the pages on which they are found. It also lists the titles of the appendices which are not included in the report, but which are available in the original documents.

Appendix 8 - Summary of the report. This appendix is a summary of the report, and is included in the report. It lists the titles of the appendices and the pages on which they are found. It also lists the titles of the appendices which are not included in the report, but which are available in the original documents.

Appendix 9 - Summary of the report. This appendix is a summary of the report, and is included in the report. It lists the titles of the appendices and the pages on which they are found. It also lists the titles of the appendices which are not included in the report, but which are available in the original documents.

Appendix 10 - Summary of the report. This appendix is a summary of the report, and is included in the report. It lists the titles of the appendices and the pages on which they are found. It also lists the titles of the appendices which are not included in the report, but which are available in the original documents.

CHAPTER II

APPLICATION OF METHODS TO MINIMIZE HUMAN RISKS AND PHYSICAL DANGERS

Based upon a complete recorded survey of human risks and physical dangers, suitable, effective, and plan-wise action must be taken to put the information to use. We have the job ahead of getting each and every one of us to do the best known thing at the right time in prevention work. The bulk of the action will have to be taken by human beings through other human beings. Much of it will be man-to-man work. Of prime importance we have the task of getting close to our local people, of knowing them as intimately as possible, of studying ways and means of directing their thoughts into the right channels. Such a task requires the best of tact, diplomacy, and fellowship. It demands a keen insight into the workings of a man's mind, a study of the facts or fancies which cause him to reason certain ways. Personal contact with the head of every resident family on and immediately adjacent to the district, with every regular forest user, and with as many others as possible may be necessary in certain situations.

Reduction of physical danger requires only observing eyes and job-dispatching ability.

There must be action on and participation in broadcast methods of public education, face to face, in groups, or by use of the mails. This, however, is of secondary importance to the man-to-man job of education in care with fire in the woods.

The application of methods to overcome human risks and physical dangers divides itself into five parts as follows:

1. Personal contact.
2. Law enforcement.
3. Broadcast prevention work.
4. Reduction of physical danger.
5. Keeping prevention work alive.

1. PERSONAL CONTACT

PRINCIPLE 4: Timely, diligent, and effective execution of plans.

The standards of personal contact will be as follows:

(a) *Zones of high risk.*—One adult member of each family is to be interviewed by the ranger at least twice each year. The supervisor or a member of his staff will visit such zones and interview an adult member of not less than 20 per cent of the families and all key men at least once a year.

(b) *Zones of medium risk.*—The district ranger or his assistant will interview one adult member of each family and see each key man at least once each year. The supervisor or a member of his staff will visit such areas at least once each year and interview key individuals.

(c) *Zones of normal or low risk.*—Where the community as a whole is known to be favorable to fire prevention, the district ranger will maintain a selective list of resident families and key individuals, composed of those who for some good reason appear to warrant individual educational effort by mail or in person. Families qualified as to location and who do or may be expected to use directly the national forest for some purpose, who constitute a brush burner or other particular fire risk, or who for any other reason in the ranger's judgment should be contacted, are properly covered in this list. So listed, the minimum requirement is annual personal contact by the ranger with at least one adult member of the family, or with the key individual, such contacts to be made

systematically and in the course of current trips, in months just preceding or during fire seasons.

The influential individual or family should be carefully cultivated through thoroughly, adequate contact.

A few suggestions for methods of approach are given on pages 102-105 of the appendix.

2. LAW ENFORCEMENT

Adequate law enforcement is a valuable aid in fire-prevention work. Its value lies in its ability to make people think first and act afterwards when considering the use of fire in the woods. As a threat it is often poor propaganda, but as a reminder it is priceless. Knowledge of the State and Federal laws among the residents and users of the forest is essential. Knowledge also that they will be invoked where needed supplies splendid follow-up. Lack of adequate and impartial law enforcement breeds disrespect for the law itself. The mere fact that it is on the statute books does not make it an effective fire-prevention tool. It must be backed up by action in every actionable case.

Fire officers will maintain close contact and good working relationships with peace officers.

A fire trespass case lost may not be a total loss. The fact that it has been pushed by the service to the limit has its very tangible prevention value.

Procedure in working out cases is outlined on pages 94-102, inclusive, of the appendix.

3. BROADCAST PREVENTION WORK

Contact record.—The contact record for ranger district and forest will be kept as complete and up to date as possible. Rangers will constantly carry the P-R-7¹ series of contact record forms and at every opportunity pick up new contacts, correct old ones, and keep the record alive and accurate, getting corrections into the supervisor's office as required in local plans of

¹ Formerly P-D-7. All former D-7 forms will be used until the supplies are exhausted. When reprinted an "R" designation will be used.

work. The contact record is indispensable for the dissemination of written or printed educational material. It is valuable for purposes other than fire prevention.

Letters and publications.—The use of personal letters well written, meaty, and to the point, conveying a specific fire-prevention message is strongly recommended. Such letters give a personal touch that the mere mailing of a pamphlet does not provide.

Each pamphlet, booklet, or other printed fire-prevention publication will have a well thought out plan of distribution developed for it, assuring that the right publication gets into the right hands at the right time. Full advantage will be taken of the school service. Stocks of publications in field offices will be kept adequate but not overloaded. Forest officers will carry a suitable supply on field trips.

Posters and signs.—We have gotten away from the indiscriminate plastering of trees, telephone poles, buildings, etc., with fire posters. Fewer posters, well mounted, well placed, and bearing an appropriate, timely message will be the rule. Posters will be kept fresh, timely, and neat. The poster location map and plan will be kept up to date.

Lectures.—The importance of lecture work must be recognized by all forest officers. It must cover not only those audiences in cities, towns, and rural communities, but those in the backwoods sections. Lectures are more effective if illustrated. Gifted speakers outside of the service will be enlisted in this work. The supervisor or qualified member of his staff will seek opportunity to deliver at least six lectures each year before civic clubs or other assemblies at those points where the greatest result will be obtained. Every qualified ranger will make at least two lectures before some civic organization or other gathering within his district each year.

Talks.—Informal addresses are to be made by all forest officers at every opportunity. At least one contact will be made by the supervisor, member of his staff, or the ranger at every school within the forest boundary each year and as many schools outside as

time permits, and a short talk to the pupils will be made if the opportunity is given. Informal talks by forest officers should be made at gatherings such as picnics, camp-fire groups, and church socials whenever the chance is offered.

Radio.—Every opportunity will be grasped by all forest officers to talk, lecture, or submit material for broadcasting at available radio stations.

Newspapers, periodicals, and magazines.—Every opportunity will be made to get forest news into papers and special articles into magazines. All rangers will see that items of interest are carried by the local papers, and the supervisor and staff will do likewise in the wider field available to them. Each forest plan will set up minimum requirements for each officer.

Schools.—The introduction of short forestry courses emphasizing prevention, the preparation of forestry textbooks, stimulation of essay contests, the distribution of prevention literature, the use of schools in forestry programs, Arbor Day exercises, etc., will be undertaken by forest officers.

Motion pictures.—The supervisor will secure and prepare in advance a suitable itinerary for Government owned and operated motion-picture and stereopticon outfits by seeing that they get into backwoods sections. The fullest possible use of all moving-picture theaters in and adjacent to the forest for the showing of Forest Service fire films will be made by forest officers. The obtaining of these films is a function of the supervisor. Arrangements for showing them to the best advantage is a joint duty of the supervisor and ranger. Additional use of theaters will be made by supplying radio mats, slides, or other propaganda. Great care must be taken in selection of film subjects and proper contacts for shots and mats:

Use material suited to audience.

Convey the story that is required.

Use something applicable so far as possible to the section in which shown; your people will be most interested in things with which they are familiar.

Exhibits.—Exhibits will be prepared and placed as follows when results promise to be commensurate with time and money expended: Fairs, schools, libraries, window displays, industrial parades, and educational panels.

Outside publications.—Every opportunity will be used to put prevention material in the following and similar publications:

Railroad time tables and tourist folders.

Chambers of commerce prospectus.

Hotel stationery.

Hunting licenses.

Trade magazines.

Road guides and maps.

A check list of contact agencies will be found on page 102 of the appendix.

The combined ingenuity, resourcefulness, and job dispatching ability of the regional office, the supervisor, and ranger will be needed to plan the effective use of the above prevention agencies to get the results desired. The results of risk surveys, plans of action, and application of methods and technique for putting plans into effect will never remain static. Continual changes in population, trends of thought, physical dangers, and other influences on the prevention problem demand watchfulness from all forest officers alive to the situation.

4. REDUCTION OF PHYSICAL DANGERS

Physical dangers are tangible. They are on the ground, spread out for us to see. They are not in the mind of local man or visitor. They are not hard to get at. An area of summer-cut hardwood slash, an inflammable right of way, a bad windfall, areas of dry-grass land, etc., are examples.

Recognition of fire traps as such is incumbent upon every forest officer.

Every effort will be made to reduce such dangers to the minimum. If they can not be eliminated, steps will be taken to protect them as far as possible against the human risk. They will be mapped on the

risk zone map and shown as dangers by appropriate symbol. They are in effect areas of high inflammability which must be accounted for in prevention plans. Such areas will not set themselves afire. The reduction of the human risk at such dangerous locations is the problem.

This may be accomplished by :

Lopping, scattering, or piling and burning slash at the time of cutting.

Clearing, plowing, or burning protective strips.

Provision of protective patrol.

Closure to smoking.

Complete closure.

Elimination of sparks from steam machinery.

5. KEEPING PREVENTION WORK ALIVE

PRINCIPLE 5: Constant vigilance after plans are drafted to sense, identify and cope with new risks, shifting risks, and enlarged risks.

This principle is self-explanatory. Wide-awakeness to changing conditions is essential. Risks and dangers must not be allowed to creep up on us and catch us napping. Each change first sensed must be identified. When identified, prompt alterations of plans must be made to meet the changing situations or new situations. Our present analysis and plan system provide convenient means for revision as needed to meet changed conditions.

PRINCIPLE 6: Provision for prompt shift of men to new duties, new positions, or the employment of emergency guards as risks shift or enlarge, or as new risks develop.

Regular men.—There should be no hesitation in shifting regular men to new duties or new positions to successfully combat certain shifting, enlarged, or new risks. Certain of the force may have peculiar qualifications for special lines of prevention work; in fact, ability in prevention work should be well considered in the selection of guards. Those will be recognized in plans and the men used promptly before risks get out of hand. For example, a certain guard

may be unusually apt in dealing with the tourists recently let into a new area as the result of a new road or highway. His ability should be capitalized.

Emergency guards.—Supervisors are authorized to put on such emergency guards as are needed to handle actual fire-emergency conditions for periods of two days or less without special authority from the regional forester. For emergency guard employment for periods longer than two days authority should be requested in advance by night telegram to the regional forester, giving concise explanation of the need. Rangers will communicate with the supervisor by telephone or wire before putting on emergency guards, doing this sufficiently early to allow time for authority to be obtained from the regional office.

Because of the limitations placed on the use of emergency guards it is necessary that the need for them be carefully considered. Nevertheless, when they are needed they should be employed promptly as above and released as soon as the emergency has passed.

Key individuals.—Local influential men should be developed to assist in the broadcast prevention work.

Closure.—As a prevention measure valuable for competing with fluctuating and intensified risks, closure is effective. It will be worked out in advance on specific areas of high risk, providing in planwise fashion for location of closure notices, newspaper or radio publicity, and the man power to enforce it showing the location of closure patrolman posts, instructions to such patrolmen, and methods of checking authorized use in and out.

PRINCIPLE 7: Training of forces in survey and identification of risks, public contacts, control of specific risks, reduction of inflammability, and law enforcement.

Training in fire prevention is essential and has a very definite place in all fire-training effort. Fire prevention is a big job. It requires the intelligent activity of every man on the permanent and temporary force. The fire guard, for example, may and often

does know the local human problem more intimately than the ranger. He has ways and means of approach that close acquaintance of friendship bring him which may be of inestimable value in seeking the idea of care with fire. It is probable that many of our temporary men do not know or can not impart to others why we want to prevent fire in the woods. They may not know the tangible damages resulting from fire. This information must be supplied. Armed with it and trained in methods of putting it across, they become effective workers. The same is true for the identification of risks, reduction of inflammability, and for law enforcement. The guards can and should be developed into more than mere watchmen and crew bosses. Training in fire-prevention methods will be a part of all group or individual training work. The supervisor will head it up and the work will be followed to successful completion by the district ranger.

PRINCIPLE 8: Application of creative thought, foresight, and alertness in sensing opportunities and providing needed facilities for current and future prevention programs.

It is absolutely necessary that study of the situation be given a lot of hard thinking. Advance thinking and plan making are far better than post-mortems. Receptiveness to new ideas is essential. Open-mindedness will be the rule. Every member of the force should be free to make suggestions for improvement in methods. Ideas for new posters, unusual methods of presenting the prevention problem, intelligent use of the traveling motion-picture outfit, special fire meetings, organization of prevention associations, use of badges and buttons, formation of school clubs, and many other ways and means of developing the idea of care with fire can be thought out, worked out, and put across if the men who have the responsibility for fire control on the national forests put their minds to it.

Foresightedness, looking ahead for opportunities to appropriately inject the fire message into community or group meetings of all descriptions, anticipating

the occurrence of fairs, conventions, sight-seeing excursions, etc., and providing the facilities to get the message over, must be forthcoming from every man on the force.

PRINCIPLE 9: Participation in the state-wide field of forest-fire prevention, the demands of local fire problems and other Forest Service work being given due priority.

Protection of national forest land comes first. The needs of other Forest Service work have high priority. But within the limits of time available and pressure of other work there should be, if possible, some co-operative effort given to participation in state-wide or regional forest-fire prevention. To some extent the influence of general public opinion will be felt on our local problems. A fire-minded public will frown on carelessness or incendiarism; it will assist us in law enforcement; it will bring to the ranger district a higher percentage of fire-minded visitors. For these and other reasons participation in state-wide fire-prevention work is justified. The time devoted to such work must be commensurate with the local benefit which will be reaped. It will be set out for each forest officer in his plan of work.

PART II.—PREPAREDNESS

THE FIRE CODE

Principles

1. POSSESSION OF EXACT AND DETAILED KNOWLEDGE OF PREPAREDNESS REQUIREMENTS of each protection unit, founded on analysis of fire history, searching into such factors as fire traps, risks, fluctuations in intensity of danger, rates of spread, and probable future fire loads.
2. Provision for:
 - DETECTION.—Comprehending the entire protective area, accurate, sustained, and prompt;
 - COMMUNICATION.—Linking effectively the detection, dispatching, and suppression forces;
 - MAN POWER.—First, second, and third lines of defense; definitely enrolled, classified, organized, and assigned; ample in number for two or more simultaneous fires; well-instructed; led by trained foreman. (Man power in excess of capacity and ability of skilled foremen on a job is waste.)
 - TOOLS—SUPPLIES AND EQUIPMENT.—In standard units, ample, well-selected, coordinated with sources of man power; food, canvas, and bedding not forgotten;
 - TRANSPORTATION.—Making readily available man power, food, tools, and equipment.
3. PRODUCTION OF FIRE PLANS through combined thought, participation and effort of supervisor, staff, and rangers.
4. TRAINING OF PERSONNEL (forest officers and assistants) in preparedness; and to insure requisite skill in suppression—constant alertness for evidence of good and bad work—for trends, and indicators of changing conditions—so that each will take exactly the steps warranted by circumstances from start to finish.
5. REALIZATION that with the best available fire boss on the line every fire must be hit promptly and hard, and mopped up to the point of security before the first “burning hour” of to-morrow or to-day.

6. REALIZATION that fires out of hand usually are the results of poor workmanship or delayed attack.
7. REALIZATION that effective suppression of fires, small or big, means—cutting off spread—“fire-tight” mopping up on the heels of the line builders, and “killing” every potential fire-spreading spark before abandonment.

RESPONSIBILITY

The supervisor is responsible for the state of preparedness of man power and material facilities available for fire suppression on his forest and for the presentation of additional needs to the regional forester.

Under the direction and advice of the forest supervisor the district ranger is responsible for the state of preparedness of man power and material facilities on his ranger district and for the presentation of additional needs to the forest supervisor.

PERSONAL ACCOUNTABILITY

Supervisors and rangers are personally accountable for maintaining the state of preparedness to acceptable standards. Failures brought to light through current inspection and which are not corrected promptly with the facilities at hand or available, whether they result in mishandled fires or not, will be grounds for appropriate disciplinary action. It should not be necessary to await the occurrence of mishandled fires resulting from poor preparedness action to initiate personnel action. The state of preparedness is a measurable thing which can be checked through searching inspection. The need for personnel action should be developed before the occurrence of the fire and not afterwards.

THE JOB OF BEING “ALL SET”

CHAPTER I

PREPARATION OF THE PLANT

The contents of this chapter will have to do with maintaining a high standard of preparedness in man power and physical resources. The man power comprises forest officers, including the regular and temporary force, cooperating agencies, and labor. The physical resources are the towers, cabins, telephone lines, roads, trails, tools, small equipment, trucks, bedding, canvas, grub, etc. That the man power be organized and ably led is mandatory. That all physical resources be adequate, balanced, and well conditioned at all times is also required.

We shall never be able to prevent all the fires even with the application of the most intensive prevention measures. Fires will occur and we must be prepared.

1. KNOWLEDGE OF THE SITUATION

PRINCIPLE 1: Possession of exact and detailed knowledge of preparedness requirements of each protection unit, founded on analysis of fire history, searching into such factors as fire traps, risks, fluctuations in intensity of danger, rates of spread and probable future fire loads.

Up-to-date, exact, and detailed knowledge of the situation on a given protection unit is a first essential. Constant vigilance for fluctuating intensity of danger, new risks, fire traps, and probable future fire loads is demanded. Only with complete knowledge of a given set of conditions can we intelligently prepare to meet them. Much of the knowledge has been gained through analysis of risks and action to overcome them as treated in Part I of this handbook.

They were analyzed then for the purpose of providing ways and means to prevent fires from starting. Before and during the fire season they must be constantly rechecked for the purpose of preparedness. In other words, we have a certain or fluctuating set of probabilities from any one of which a fire may start. Given knowledge of this set of probabilities for a protection unit, we prepare to meet it. Without it we are working in the dark.

2. DETECTION

PRINCIPLE 2: Comprehending the entire protective area, accurate, sustained, and prompt.

The detection system for the protection unit will utilize every detection agency available to bring as high a percentage of the protected area under direct visibility as practicable. These agencies are:

Forest Service primary lookouts.

Forest Service secondary or supplemental lookouts.

Forest Service patrolmen.

State or association lookouts.

Settlers or city residents.

Bus and stage drivers and motorists.

Track walkers and power-line patrolmen.

Train crews.

Rural mail carriers.

Aircraft, etc.

Intensification of detection system, if inadequate, may be obtained by:

Establishing new primary lookouts.

Placing firemen on secondary peaks.

Inauguration of patrol along well chosen routes.

Hooking up outside agencies by telephones.

Enlisting every possible source of cooperation.

Permanent primary lookout structures will be constructed only after accurate visibility maps showing percentages of seen and unseen areas have demonstrated the exact location and necessary height of the structure. Provision will be made for the lookout man to remain at his post 24 hours a day. The steel

tower with observatory and living quarters combined on top, or with observatory on top and living quarters at the base, is standard for all primary lookouts where elevation above the height of ordinary lookout house is essential to adequate visibility.

The observatory will be equipped as follows:

1. Map table.
2. Map board and map.
3. Range-finding apparatus.
4. Telephone (preferably desk set).
5. Stool or chair.
6. Amber glasses.
7. Case containing forms, notebooks, pencils, etc.
8. Weather observing apparatus.
9. Organization chart and written instructions.
10. Telephone directory.
11. Copy of fire handbook.
12. Portable phone (optional).
13. Telephone trouble book.

The lookout man's quarters will contain:

1. Bed and bedding.
2. Chair.
3. Dining table.
4. Cookstove.
5. Heating stove or fireplace.
6. Cooking utensils.
7. Telephone extension bell or telephone.
8. One-man outfit of suppression tools and equipment and 1-day emergency rations (optional).
9. Telephone equipment—Pliers, connectors, emergency wire, insulators and brackets, climbers.
10. Wood-getting tools.
11. Bookshelf.
12. Rain barrel and bucket.
13. Ladder.

Secondary lookout structures may comprise any of the following: Towers; platforms in trees; firemen's cabins; and water tanks, windmills, etc. These will be utilized during periods of low visibility to supplement detection service from primary lookouts. Where owned by the Government and wherever else possible

they will be equipped with simple fire-finding equipment, and provisions will be made for keeping the lookout man at his post at night during dangerous periods.

Other existing lookout facilities will be taken advantage of wherever possible through extension of service telephone lines, hooking up well-located settlers by advance arrangements for detection service to be reported by messenger, telegraph, Bell telephone, auto, horseman, or runner. Coordination between Government detection systems and those of adjacent private systems will be worked out where practicable.

Investments in detection facilities will be made compatible with the risks involved.

All service-owned lookout structures will be insulated against lightning according to regional standards. (See instructions in Administrative Handbook.)

Living quarters will be provided at all primary lookout points and at those secondary points that are regularly manned.

The district ranger is responsible for maintaining improvements to the accepted standard, and each and every part of the detection improvement system will be thoroughly inspected and brought up to standard before the beginning of each fire season.

3. COMMUNICATION

PRINCIPLE 2: Linking effectively the detection, dispatching, and suppression forces.

Effective fire control is impossible without reliable means of communication primarily for the purpose of dispatching suppression crews. The telephone is the most efficient means of report and each forest will work toward the end of putting every part of the suppression organization in direct touch with the detection system. The Forest Service telephone system will be supplemented by and correlated with the Bell telephone, farmers' lines, the Western Union, Postal, and railroad telegraph, or other commercial lines. Cooperative agreements for the use of such supple-

mental communication systems may be arranged by the supervisor as a preparedness job.

During fire periods all available organized man power at construction camps, sawmill camps, or elsewhere will be connected by temporary lines, making use of emergency wire and the portable phones where such preparedness is warranted. Proper planning for such a communication system is the responsibility of the supervisor, and no fire plan is complete without a definite program to meet all emergencies.

Tests.—A high standard of operation of Government-owned telephone lines will be required and service standards of construction and maintenance will be observed. To this end definite arrangements will be made for daily tests of the Forest Service communication system during periods of fire danger. Daily, at a prearranged hour, all suppression personnel will be at their phones and district ranger, dispatcher, or other properly located officer will call each in turn. Instructions to guards shall provide for daily test calls to the lookout. This establishes the working order of the Government system and at the same time gives an opportunity for the issuing of any special plans or instructions for the day. Any failure to get satisfactory service over the line will call for immediate investigation and repair by the best qualified man available. A check list of things to look for in case of trouble is as follows:

1. Lightning arrester—blocks clean.
2. Open switch at cut-out.
3. Terminals loose outside.
4. Ground rod dry.
5. Battery connections loose.
6. Loose connections inside box.
7. Batteries weak (you can hear, but not distinctly).
8. Open line—crank turns too easily.
9. Grounded or shorted line—crank turns too hard.

Failure to find trouble after these tests requires reference to telephone trouble book.

Maintenance.—Funds for the maintenance of the telephone system are provided. Current maintenance

is the rule. Lines will not be allowed to go down. A high standard of line maintenance is required as specified in the telephone manual. The telephone system will be thoroughly overhauled on each ranger district prior to the opening of each fire season. It shall be in satisfactory working order by the opening dates, and shall be kept in such order throughout the fire season.

Emergency repairs.—Advance plans, usually incorporated in guard and lookout instructions will be made for dividing the system into sections for prompt emergency repairs. Guards will be instructed as to the boundaries of their sections, simple rules for line and instrument repair will be furnished them, and they will be equipped to make such repairs at short notice.

The responsibility for the maintenance of the system to acceptable standards rests with the district ranger.

4. ORGANIZATION OF MAN POWER

PRINCIPLE 2: First, second, and third lines of defense; definitely enrolled, classified, organized, and assigned; ample in number for two or more simultaneous fires; well instructed; led by trained foremen. (*Man-power in excess of capacity and ability of skilled foremen on a job is waste.*)

It is a basic principle that man power is only effective as it is properly organized, supervised, and led.

The fire-control organization can be no better than the framework, made up of all its officers, upon which it is built. Each officer, from the supervisor to the crew boss, must exercise those qualities of leadership, judgment, and ability that are indispensable to success in any organization. The authority, function, and responsibility must be definitely determined and fully understood in advance. Each officer to whom authority is delegated must assume full responsibility for the exercise of that authority.

Warden organization.—Reduction of "preparedness costs through the development of adequate suppression force comprised of trained warden crews is a prime

objective in organizing man power. Primary detection service will probably always be furnished by the Government.

The organization of man power is largely the duty of the district ranger. The entire forest should be covered as comprehensively as conditions warrant and require. Ordinarily the aim should be to have a crew so located that any point can be reached within one hour's elapsed travel time.

Improvement crews.—Wherever and whenever feasible, road, trail, and other improvement work will be so timed that such organized man power will be available for fire-suppression duty. The location of improvement crews, in so far as practicable during the fire season, should be such as to provide quick access to areas of great danger. Fire fighting duties will be a part of the contract of hire for foremen and laborers in such crews. See pages 112–114 of the appendix on correlation of road and trail and fire control activities. Conversely, it is desirable that qualified and valuable members of the fire-control force be given opportunity for additional employment out of fire season in improvement crews. See Administrative Handbook.

Selection of leaders and crews.—The selection of leaders in the fire organization will depend upon certain mental and physical qualifications. A check list of these qualifications is found on pages 108–111, inclusive, of the appendix.

As a general rule, organized permanent crews such as road crews, section crews, sawmill and logging crews are most useful as suppression crews. They should be directed by their own foreman or boss provided he is qualified for such work.

Local men usually will be chosen for fire crews. In areas where incendiarism is prevalent, it may be necessary to bring in leaders and crew members to prevent the inducement offered local men to set fires in order to get work fighting them. In such areas the greatest care must be taken in the selection of men.

First, second, and third lines of defense.—It is recognized that no hard and fast rules can be set up for the composition of the first, second, and third lines of defense. The best available agency must be used first. The following suggestions are made:

The first line should consist of units or crews whose efficiency is the highest and availability the best, for example: Near-by Forest Service crews, near-by tried and proven warden crews, other tested crews.

The second line shall be made up of the next most efficient and available crews, for example: Warden crews from adjoining areas; Forest Service crews though remote; Forest Service crews from other ranger districts of the forest; railroad crews, highway crews, etc.; other organized crews though remote.

The third line will be called out only in cases of emergency, but it must be provided for and shown on the organization chart; it may be made up of such units as: Warden crews from remote areas, Forest Service crews from other forests, crews from industrial plants, men from labor agencies, miscellaneous unorganized man power.

Interforest dispatch—Bristol depot.—For instructions concerning interforest dispatch and the use of the Bristol supply depot see the Administrative Handbook.

5. TOOLS, SUPPLIES, EQUIPMENT, AND TRANSPORTATION

PRINCIPLE 2: In standard units, ample, well-selected, coordinated with sources of man power; food, canvas, and bedding not forgotten.

Tools and equipment.

Standard units.—Because of the varying conditions in Region 7, a region-wide standard unit is not practicable. Standardization is necessary, however, to provide facility of inspection, assurance of proper quantity and kind, and to provide ease in grouping. Local standards will be set up for the forest or ranger

district and the following factors will be considered in establishing such local standards:

1. Local composition of ground cover and inflammable material.
2. Available local organized manpower.
3. Availability of water.
4. Probable rates of spread.
5. Existence of risk.
6. Proper balance between cutting, raking, and digging tools.

Ample outfits will be provided. Supplies in excess of available manpower is waste, however. Near-by sources, service owned, or available by emergency purchase, should enter the picture.

Excess stocks.—We must bear in mind the necessity for keeping the investment in seldom-used tools, supplies, and equipment to a safe minimum. With constantly improving transportation facilities reducing travel time and making distant sources available on short notice, the use of central caches for dispatch to nearly every fire on the protection unit should be given serious consideration. On units where such conditions exist, local standard units may only be designed to equip the first crew going to the fire with immediate follow-up to come by motor from a near-by central cache.

Well-selected outfits.—Local standards will designate for each cache the selection of tools, equipment, and supplies to be contained in it. Suggested outfits for crews of two sizes are given on page 114 of the appendix; the small crew unit (6-man) and the large crew unit (25-man). Crew outfits of varying sizes in between should be made up of multiples of the small unit.

Grouping in outfits.—Grouping will be in crew units and not by individual tools. The object of grouping is to secure prompt getaway, to provide that all the tools necessary to properly equip a crew will go to the fire together and nothing essential will be left behind even if picked up by messengers or other unskilled persons.

Protection against disturbance.—Provision will be made for assurance that tools and equipment will always be in readiness. Tool boxes and metal caches carefully designed and fabricated to suit the unit contents will be provided at locations where there exists the possibility of disturbance. Such containers will be labeled:

No. —

———— National Forest

Fire Tools

For use in case of fire only

Out-of-door containers will be weather-proofed. All containers will be sealed and Form 3-R-7 filled out and be placed on the inside of the container. The use of containers for indoor storage at regular forest officers' headquarters will be optional with the supervisor.

Condition of outfits.—Tools and equipment will be ready for immediate use at all times. Upon return from a fire all will be promptly reconditioned, and losses and breakages replaced. Edged tools will be kept continually sharp, greased, and tightly handled. Water containers, canvas or metal, will be inspected currently to assure usability. Tools and equipment will be marked in accordance with the instructions on page 115 of the appendix.

Outfits on Government trucks and forest officers' privately owned cars.—These outfits shall be specified by local standards. Minimum requirements shall be that supervisors' $\frac{1}{2}$ -ton trucks and forest officers' personal cars will each carry a 3-man outfit.

Special Government-owned fire trucks and road trucks set aside for fire-control purposes will each carry not less than a 12-man outfit.

Such other Government-owned trucks as local standards may dictate will each carry not less than a 6-man outfit.

Local forest standards will clearly prescribe the conditions under which forest officers traveling on foot or on horseback will carry fire tools and what tools shall be carried.

Emergency supply.—Sources of emergency supplies of tools and equipment will be listed on the organization chart. Lists of supplies will be filed with merchants for use in filling telephone or telegraphic orders.

Pumps, hose, tanks, etc.—With increasing use of water in control and mopping-up work, the region will be equipped with an increasing investment in spray pumps with back tanks, power pumps with hose and fittings, tank trucks, etc. The distribution of such equipment will be governed by the water supply, the type and amount of fuel on given areas, and the available man power. While not mandatory, it is desirable that at least one hand pump with back tank be supplied to each tool cache in those localities where water is available and can be used to good advantage. Hand pumps will be kept in good repair at all times. Broken or worn-out parts will be replaced immediately and working parts protected from corrosion.

Power pumps with their accessories are expensive and require men of some mechanical ability to run them satisfactorily. They will never be available in large numbers and it is extremely important that they be located so as to serve the largest territory in the shortest time. This implies portability first by truck, car, or express and second by pack animal or man power. For these reasons, power pumps, accessories, and hose will be kept packed in suitable sturdy containers for ready transport by any means to the scene of action. Pumps should be secured in boxes so that they will not be damaged in transport, and all pumping equipment kept in readiness for immediate use. After use, pumps will be thoroughly cleaned, emptied of fuel, oil, and water and reconditioned for the next call, and hose will be carefully repacked. Linen hose should be thoroughly dried before repacking.

The successful operation of power pumps and hose on the fire line requires special training and practice. For this reason, a special crew of three to five men should be organized around each power pump and should accompany it to local fires. This crew, under

the direction of the district ranger, should be held responsible for the condition of the outfit at all times while it is serving in the local territory.

In localities where water is scarce but where motor transport to or near the burning edge of a fire is comparatively easy, as in the case in the pine forests of the South, special tank trucks are a part of the water equipment. Power pumps either attached to the motor of the truck or separate units of the Pacific pump type, are a part of the equipment. Such outfits like the trucks of the city fire department will be kept in constant readiness and in good operating condition at all times.

All water equipment will be thoroughly overhauled, inspected, checked, and conditioned prior to the opening of each fire season and checked during the season sufficiently often to assure perfect condition and readiness.

Training in the use of water equipment will be a part of each training camp or group fire meeting.

Requests for interforest dispatch of pumps and special equipment will be made through the regional forester. Interdistrict dispatch will be handled by the supervisor.

Food, Canvas, and Bedding.

Emergency rations.—These consisting of 1-man, 1-day packages will be purchased by the regional office. Supervisors are required to state their needs in October for use during the following fiscal year. Needs will be based on probable emergency use only. With our relative accessibility, the use of emergency fire rations will be confined to provision of the first three meals only. Arrangements for supplemental supplies purchased locally will be made when control time will exceed 12 hours.

Prior to the beginning of each fire season, 1-man, 1-day emergency rations will be secured and distributed. Each guard or warden will receive a supply in accordance with local standards. A reserve supply will be kept at ranger headquarters to replenish guard and warden supplies.

Local forest standards will specify the condition under which forest officers traveling on foot or horseback will carry emergency ration packs.

Supervisors' half-ton trucks will carry three 1-man, 1-day emergency ration packs.

Forest officers' cars, used in fire-control work, will carry three 1-man, 1-day emergency ration packs.

Special Government-owned fire-control trucks and road trucks set apart for fire-control purposes will carry rations for a 12-man crew for three meals.

Such other Government-owned trucks as local standards may dictate will each carry rations for a 6-man crew.

Crew rations.—A supply of crew rations for the use of fire fighters will be purchased and distributed to points designated by the organization chart. The frequency of fires and the available man power will constitute the basis for determining the number of ration caches to be established on each forest.

Ration caches may be located at the following places :

1. Ranger headquarters.
2. Guard quarters.
3. Camps of improvement crews.
4. Camps of special crews.
5. Points where man power starts to fires.
6. Strategic points in more or less inaccessible areas where fires are of frequent occurrence.

The amount of rations kept in each cache will depend on the availability of man power, seriousness and frequency of fires, and convenience of supply bases.

Rodent and insect proof metal or wood boxes will be provided as containers for rations.

A minimum ration for a 6-man crew for one day will be kept packed in a ruck sack in each ration cache.

Ration caches will be inspected prior to the beginning of fire seasons by the responsible officer and will be checked for the following :

1. Too much or not enough.
2. Condition.
3. Kind and balance.
4. Outfit packed.

When practicable, tool and ration caches will be located at the same point.

Ration lists.—Suggested lists are given on page 27 of the appendix.

Mess outfits.—The use of 1-man, 1-day emergency rations and the prompt follow-up with regular food supplies and mess equipment does away with the extensive use of 1-man mess kits. Regular nested outfits for units of 6, 10, 15, and 20 man crews, as shown in the Equipment Manual, will be provided at ration and the larger tool caches. The organization chart will specify the location, size, and number of such outfits.

Mess outfits will be kept intact, clean, and ready for instant use. They should be and usually are provided with suitable metal containers and will be kept sealed. A list of contents will be kept inside the container.

In the event of the necessity for emergency purchase of mess equipment, a satisfactory list for a 6-man crew is given on page 115 of the appendix.

Canvas.—Will be provided at central caches and for fire trucks. Because of their compactness, flies will ordinarily be used instead of tents. The fire plan will designate the amount and location of needed canvas. After use all canvas will be thoroughly dried, carefully folded, and stored where it will be free from rodent or mildew damage.

Bedding.—Will be provided at central caches and for fire trucks in accordance with provisions in the organization chart. Supplies will be adequate to provide each man with at least one blanket. Blankets will be properly marked by stencil and will be protected from rodents and moths.

The construction of rodent-proof storerooms at central caches is recommended.

Transportation.

PRINCIPLE 2: Making readily available man power, food, tools, and equipment.

Roads and trails.—Existing routes of travel will be brought up to standard, new routes constructed, and all maintained to the proper standard with the idea in mind of reducing travel time to the minimum, taking into consideration topographic and financial conditions existing. Motorized transportation is the required means of travel where applicable, and roads will be so planned and constructed as to take the fullest advantage of its added speed. The road system will be supplemented by a carefully planned system of primary trails, secondary trails, and manways so as to give each and every part of the forest the highest degree of accessibility which topography, values at stake, and costs dictate.

Privately owned cars and trucks.—On those forests where privately owned motor vehicles constitute the nearest, quickest secured, surest, and cheapest source of transportation, such will be considered the main source of supply and arrangements by contract under the most favorable terms to the Government will be made with the owners of such vehicles prior to each fire season. This source of vehicles will be supplemented by any Government-owned automobiles and the cars of the forest officers, all sources to be definitely listed in the order of their desirability on the organization chart or sheets.

Government-owned cars and trucks.—On those forests where privately owned motor vehicles do not furnish an adequate and dependable means of transportation, the building up of an effective fleet of Government-owned machines is required. This will involve in many instances the purchase of special motor equipment for the purpose, supplemented by road and acquisition trucks already in Federal ownership. Where the conditions warrant, road and acquisition trucks will be set aside for fire purposes during periods when they may be needed. All motor equipment will be kept in good repair.

All other transportation facilities.—Boats, railroad speeders, wagons, pack animals, aircraft, whether Government property or privately owned, will be made available through advance arrangement and listed with a scheme for mobilization in the fire plan. Government-owned transportation will be in readiness constantly during the fire season. Provision for extra supplies of fuel, lubricants, or feed will be made beforehand.

6. WEATHER STUDIES

Observance of fire days will be made and a record kept in the supervisor's office based on observations made by the rangers. Number of fire days for the period will be reported on the 10-day fire report.

Recording of weather data.—The inflammability of the ground cover and the rate of spread of fire is dependent upon certain physical factors. Fire control to be most effective must be based upon an understanding of and directed in accordance with such factors. Not only must we be able to size up conditions as they are at the time of a fire, but in addition it is important that we attempt to anticipate what they will be several hours, even days, hence.

A part of preparedness has to do with collection of weather data which in future years will serve as an index of what may be expected under certain conditions. Such studies must be based upon information gathered locally and their usefulness will depend upon their being carefully recorded, correlated, and analyzed.

Where instruments can be provided at improved lookout stations, dispatchers' headquarters, and wherever else practicable, weather data will be collected. A special form (29-R-7) is provided for this purpose. If it is not possible to collect all the data listed, such of it will be gathered as can be taken under the conditions.

The use to which weather data can be put is the forecasting of:

1. Occurrence and duration of peak dry periods.

2. Direction of prevailing wind.
3. Number of windy days per season.
4. Number of cloudy days per season.
5. Amount and form of precipitation.
6. Seasonal range and mean temperature. (Temperature has a most vital effect upon humidity.)
7. Relative humidity under various conditions.

Weather studies, using report of previous lightning fires as the basis, will fix zones where lightning fires may be expected.

The forest supervisor will take such steps as are necessary to secure the best, most applicable Weather Bureau forecasts, and will relay the information at once to the fire force, guards, lookouts, rangers, etc. Most broadcasting stations put such data on the air each day or night.

Observance of dangerously low humidities should be reported to adjoining forests.

7. ORGANIZATION OF COOPERATIVE RESOURCES

The forests of Region 7 are peculiarly dependent upon cooperative resources for effective fire control. This is due to the unconsolidated conditions and the large number of inhabitants in and near the forests with the resultant increase in risk, as well as the increased opportunity for cooperation.

The objective toward which we are working is the development and coordination of our cooperative resources to the point where our fire organization can be reduced to a detection system, depending on our organization of cooperative forces as an adequate defense.

The first step toward this end is the responsibility of the supervisor to list every available cooperative agency and use every resource at his command to enlist the active help of each. Such opportunities exist on all forests. The most common and most useful agencies are:

1. State and county fire organizations.

2. Private timberland owners, in and near the forest.
3. Private farm-land owners in and near the forest.
4. Wood-using industries.
5. Mining and mineral industries.
6. Railroads.
7. State and county road forces.
8. Power companies, transmission lines.
9. Bus-line operators.
10. United States post office rural carriers.
11. Other industries with large labor organizations.
12. Forest users.
13. Rod and gun clubs.

Each such agency will be reached by the supervisor or ranger of the district concerned by the best method of contact, first to create a favorable attitude toward fire control, and second to enlist aid. Follow-up action, letters, literature, and other indirect methods will be necessary in many cases.

The leadership of forest officers in the development of cooperative protection is required.

The organization chart will list all active cooperative agencies with full details as to the resources available from each, including labor available, leadership available, tools, rates of pay, basis of co-operation, means of mobilization and travel. As each new agency is enlisted it will be incorporated in the plan in the most effective relationship with other agencies.

In a larger sense, cooperative protection involves the lands of the cooperative landowners as well as the national forest and should be so handled that when the work is completed the cooperator's expenditures per acre will not be less than the expenditures per acre of the Forest Service, and that the accomplishments on such privately owned lands will be up to the same standards.

The regional office will render assistance and guidance in correlating those agencies into a systematic workable force.

8. THE FIRE PLAN

PRINCIPLE 3: Production of fire plans through combined thought, participation, and effort of supervisor, staff, and rangers.

The fire plan shall consist of the following data:

1. The standards and policies governing action in the fire-control job—to be placed in the standards and policies section of the plan of work and referred to Fire Code and handbook.

2. Specific fire-control jobs—to be incorporated in the plan of work.

3. Statistical and explanatory data concerning past history, present situations, and schemes of organization and dispatch; this section of the plan shall consist of the following:

- (a) Risk-zone map.
- (b) Brief discussion of each risk in each zone.
- (c) Fire-organization map.
- (d) Organization charts or sheets.
- (e) Emergency plan of dispatch.
- (f) Cumulative fire-occurrence map.
- (g) Graphic and tabular 5-year history with brief explanatory discussion.
- (h) Specific and detailed plans for effecting closure on those areas where it is foreseen that conditions may develop or are likely to develop that will make closure necessary.
- (i) Written instructions.

These data will be assembled in a fire section of the rangers' and supervisor's work map atlas. Discussions and graphs will be typed or drawn on 18 by 21 inch sheets. Sufficient job foundation data will be extracted from the plan of work as will in the judgment of the supervisor present a clear picture of the situation on the ranger district and forest. Annual revision will be necessary.

CHAPTER II

TRAINING OF FORCES

Preparedness of man power implies training; training in groups for economy of time and exchange of ideas, and individual training at posts of duty for intensive follow-up. Training in preparedness and training in suppression are each a function of the other. Training in preparedness is an aid to effective suppression. Training in suppression is part and parcel of preparedness—being all set.

1. GROUP TRAINING

PRINCIPLE 4: Training of personnel (*forest officers and assistants*) in preparedness; and to insure requisite skill in suppression—constant alertness for evidence of good and bad work—for trends and indicators of changing conditions—so that each will take exactly the steps warranted by circumstances from start to finish.

To the end that each man will take the most effective steps in fire control and that he will make exactly the move that the changing circumstances call for from the beginning to the end of each fire, all personnel will receive the most thorough training in approved fire-control practices and methods. It is realized that the best sort of training is acquired in fire prevention, preparedness, and suppression through actual experience, and every forest officer will make sure that he takes full advantage of each opportunity to thus extend his knowledge and thereby increase his effectiveness. Viewing a situation as it is being handled by another person—a side-line observer as it were—is excellent training. An interested observer is usually

quicker to sense errors in methods and practices or others than he is to realize his own mistakes.

While experience is the best teacher in fire control, it is at one and the same time the most costly and is by no means the only way of extending fire-control knowledge. If an officer knows how and remembers to do those things which have long been recognized as indispensable to satisfactory fire control, costly errors will be largely avoided.

Forest supervisors and staffs.—The training of supervisors and their staffs will be extended through:

1. Group fire schools.
2. Supervisors' meetings.
3. Personal attendance at as many fires as possible.
4. The holding of annual forest personnel training camps in which they will take an active part.
5. Critical analysis of past fires.

Supervisors will be conversant with and guided by all valuable fire-control data that are issued from time to time and have an intimate knowledge of conditions on their own forests, supplemented by the careful analysis of local fire statistics.

Forest rangers.—Forest rangers will be trained by:

1. Study of approved fire practices and discussions with other officers.
2. Training schools, group conferences, and guard training camps.
3. Assignment to fires being handled by others.
4. Critical analysis of past fires.

Guards.—At least three days' training will be given to all untrained fire guards. There will be annual group training camps in each forest where each ranger, guard, road and trail foreman, or other officer will secure at least one day's training.

So far as possible, each per diem guard, warden, and citizen cooperator will be given at least one day's training in group training camps each year.

Advance plans for group training will be prepared so that training camps will run smoothly with a minimum of unnecessary discussion and argument.

Training by demonstration is recommended as the best method, with as little lecturing as possible. Emphasis on common failures in fire-control work is desirable. Drill in the basic principles as outlined in the Fire Code is essential. An outline for group training course is found on pages 118-122, inclusive, of the appendix.

2. INDIVIDUAL TRAINING

Every inspection visit to a fire officer at his post of duty will be considered an opportunity for individual training in the particular problems faced by that officer. Written instructions will be checked to see that the officer knows them. Questions as to action to be taken on assumed fires will be asked, and the man further advised, trained, and instructed at his post. Further individual instruction by mail is recommended.

Each guard will receive at least one day's training each year at his post of duty.

Each warden or citizen cooperator will be interviewed by the district ranger, given definite instructions and individual training to assure satisfactory compliance.

Each member of the regular fire personnel on each forest will be furnished a copy of the Regional Fire Handbook.

3. WRITTEN INSTRUCTIONS

Written instructions are a part of training and an essential of preparedness. All forest officers responsible for fire-control work shall have written instructions. They are comprised in this handbook, the fire plan as herein outlined, the forest and ranger work plans, warden handbooks, and individual instructions written to forest guards.

An outline for Instructions to Lookoutman was issued with O-Fire Plans, written instructions letter of August 22, 1929, as a guide in the preparation of local instructions.

Wardens, cooperators, and key men will be provided with written instructions prepared by the district ranger. Where a warden's handbook is in use it will constitute written instructions to wardens supplemented by such special instructions as the district ranger deems necessary.

4. KEEPING PREPAREDNESS WORK ALIVE

Our state of preparedness will never remain satisfactory for an extended period. Continual changes in burning conditions, fluctuations of risks, sudden emergencies on the going fires, require a constant mental alertness, capacity for rapid clear thinking, and a sense of well-balanced judgment.

As a matter of group and individual training of our fire-control force, these qualities must be developed to the utmost. Possession of them is a strong recommendation for employment.

Complete understanding of certain suppression principles is a part of adequate training. These are:

PRINCIPLE 5: Realization that with the best available fire boss on the line, every fire must be hit promptly and hard, and mopped up to the point of security before the first "burning hour" of to-morrow or to-day.

Preparedness training must drive home the realization that every fire presents a certain amount of work to be done during a certain number of hours; otherwise a bad situation ensues. Each fire involves the construction, holding, and mopping up of a certain number of feet, yards, or miles of fire line, and there is a definite number of hours in which to do the job. Failure to complete it in the available time means loss.

PRINCIPLE 6: Realization that fires out of hand usually are the results of poor workmanship or delayed attack.

This training principle is self-explanatory. There is little excuse for poor workmanship if selection of personnel is wise and training is adequate. Proper

preparedness requires good men, well trained, and immediately available.

PRINCIPLE 7: Realization that effective suppression of fires, small or big, means—cutting off spread—“fire-tight” mopping up on the heels of the line builders, and “killing” every potential fire-spreading spark before abandonment.

This principle is the essence of effective suppression; bringing it home by training and drill makes for a condition of mental preparedness.

PART III.—SUPPRESSION

THE FIRE CODE

Principles

1. PROMPTNESS in discovery, ACCURACY in location, and SPEED in initial report.
2. COMPLETION OF THE PICTURE: Getting fuller information (the best obtainable), and calculation of the length of line to be built and mopped up in the first work period.
3. DISPATCH of the most promptly available, worthwhile man or men AT ONCE, competently instructed.
4. PROMPT MUSTER AND DISPATCH of organized suppression units, including grub for at least one meal, on basis of calculated probabilities, with follow-up made certain as, and if, needed—men, tools, camp equipment, and grub.
5. DISPATCH OF BEST AVAILABLE FIRE BOSS to the line. (District ranger or other forest officer if possible.)
6. CONTINUOUS TRAVEL—day or night—en route to fire.

Functions of fire boss

7. IMMEDIATE ATTACK—day or night—at the apparent point or points of greatest danger.
8. SCOUTING FIRE—going around it—checking probabilities—recalculating the job to be completed before the next “burning hour”—determining its critical points.
9. REVAMPING PLAN OF ATTACK and reorganization on basis of (8) considering:
ADEQUACY OF MAN POWER AND OTHER FACILITIES, and means of getting reinforcements if required;
SUBDIVISION OF LINE into sectors or sides and provision of sector bosses—reassignment of crews;

- ESTABLISHMENT OF CAMPS NEAR LINE, as necessary, to reduce walking time to practicable minimum.
10. KEEPING INFORMED AT ALL TIMES of conditions on all sectors, acting upon information from organized sources, or personal knowledge. (*Kill rumors.*)
 11. PUSHING A SUSTAINED ATTACK—night and day—insuring closures of every section of line, and completion of back-firing, well ahead of advancing fire.
 12. CONSTRUCTION OF NARROWEST LINE, including necessary back-firing, that will corral the fire in the least time; or use of such other methods as will minimize area burned and cost—mopping up always at the heels of line builders.
 13. CONSTANT VIGILANCE in detecting and SNAP in acting upon impending changes requiring shifts of expansion of forces—coping with each situation before it gets out of hand.
 14. PROVISION FOR RELIEF AND REST of the fire boss and crews if the job—including final mopping up—is likely to overrun 18 hours. (*Invariably, place fresh crews on the line at daybreak.*)
 15. ALERTNESS TO IMPENDING EXHAUSTION of local facilities, and promptness in call for outside help.
 16. COMPLIANCE, WITHIN PRACTICAL LIMITS, with the rule of written orders from bosses to subordinates.
 17. LEADERSHIP OF THE FIRE BOSS: Constant, steady, aggressive, assertive, alert and knowing—always on the job in advance of crews. (*This counts mightily in units of held line.*)
 18. MOPPING UP—THE ANTISEPTIC OF THE FIRE OPERATION—bearing the same relation to it as the antiseptic treatment of bad body sores—indispensable to the first relief—ever present throughout the entire course of treatment, and terminating with safety ONLY WHEN ALL POSSIBILITIES OF SPREAD ARE “KILLED.”
 19. ABANDONMENT OF FIRE—permissible only when pronounced “out” by supervisor, district ranger, or their specifically authorized representative.

QUICK DISCOVERY AND GET-AWAY, PROMPT AND WELL-PLANNED ATTACK, THOROUGH MOPPING UP

PRIORITY

Fire suppression has priority over all other jobs.

RESPONSIBILITY

The district ranger is responsible for the suppression action taken on fires occurring within the fire boundary of his district, and on all fires outside this boundary which threaten national-forest land within his district.

Ranger attendance at fires.—Known class A or B fires being handled by proven leadership need not be attended by the district ranger if pressure of other important work actually demands his personal attention elsewhere.

The district ranger will attend all other fires if physically possible.

Upon the simultaneous occurrence of two or more class C fires he will attend the most dangerous, not leaving until it is thoroughly mopped up and competent leadership of patrol is provided.

If circumstances demand the ranger's attention on another fire while attending one, his decision to leave will be based on:

1. Reliability of report.
2. Relative danger of the two fires at time of decision.
3. Dependability of leadership and adequacy of man power on both fires.

If competency of leadership and labor on both fires be equal, the ranger may divide his attention between them. Otherwise he will stay with the poorer organization.

The district ranger or his authorized representative will be present to pronounce the fire "out" or safe for abandonment.

Supervisor attendance at fires.—It can not be too forcibly said that the supervisors have no more important duty than to be on as many fires as practicable. During peak fire periods, when many large fires are burning, it may be necessary that the supervisor station himself at that place on the forest where, because of such factors as communication and man power, he has the entire situation best in hand, but in general this place will be occupied by a dispatcher or other well-qualified officer.

Regional office attendance at fires.—When a bad fire situation arises on one or more forests a qualified member of the regional office will be present, if practicable, to render advice and assistance and to check suppression action.

When present, the district ranger will function as fire boss unless relieved by the supervisor.

PERSONAL ACCOUNTABILITY

Each officer is personally accountable for the success or failure of suppression action for which he is responsible. Evident failures resulting in the unnecessary loss of acreage will be thoroughly investigated by the supervisor and a complete report of action or lack of action leading up to and causing the failure will be prepared and will be accompanied by recommendations for personnel action. Recognition of successes outstanding and above accepted standards will be made in writing with appropriate recommendations.

CHAPTER I

DISCOVERY TO ATTACK (PREATTACK ACTION)

Much of the success in keeping fires to small size and losses to a minimum depends upon prompt initial action which will assure the arrival of a competent suppression force at the fire in the shortest possible time. What may be termed as "preattack" action involves two factors for success—accuracy and speed. Accuracy first, speed second. Both are of great importance. Preattack action comprises:

1. *Vigilance of detection forces*, resulting in promptness of discovery.

2. *Accuracy in location*, forestalling misguidance of suppression forces.

3. *Speed in initial report*, putting suppression forces on notice at the earliest possible moment.

4. *Determination and report of supplemental information*, resulting in a more complete picture of the nature and size of the job ahead and a calculation of the facilities in man power and equipment needed to do the job in the shortest time. Making a complete report.

5. *Quick getaway* of the most promptly available, worth-while force, competently instructed and led.

6. *Muster and dispatch of necessary organized suppression units* completely equipped.

7. *Follow-up provided for* to take care of possible misjudgment of the nature of the job in hand, or to meet added needs resulting from unforeseen adverse conditions.

8. *Fire boss*—preferably district ranger or other forest officer—the best available man to be dispatched promptly.

9. *Travel continuous*—day or night; speed with safety and without exhaustion.

1. VIGILANCE OF DETECTION FORCES

PRINCIPLE 1: Promptness in discovery, accuracy in location, and speed in initial report.

Eternal vigilance is the price of prompt discovery. We are dependent, however, upon the human machine to provide satisfactory continuity of detection service. The human machine has its limits of satisfactory service. It will not run 24 hours a day. Eyes are subject to strain and must be rested. A continued gaze for hours is not humanly possible. A well-instructed lookout will conserve his vision and at the same time give the maximum of detection service. The following is quoted from Instructions to Lookoutman:

“Keep a sharp lookout for fires. Do not gaze fixedly at one point but drag your vision slowly back and forth over your territory. Project your sight back and forth, resting your eye from near to distant parts of your field of vision for relief of strain. Take a minute for rest of your eyes now and then. Do not concentrate long on any one spot unless you are suspicious of faint gray telltale evidence of smoke.”

A lookout works alone as a rule and is far away from current inspection. For this reason conscientious, dependable persons for the position are required. Constant check by telephone from the ranger and guards below will furnish some assurance that doubtful men are on the job.

A lookout must rest, get water and fuel, eat, and sleep. For perfectly justifiable reasons, therefore, he must be away from his observational duties. Lookout structures which provide that cooking, eating, and sleeping be at the point of observation make it possible that some detection service may be obtained while these other jobs are being dispatched. Plans and instructions will provide, however, that leaving the point of observation will be only in accordance with definite schedules understood by other lookouts and checked by telephone communication. No lookout will leave his vicinity of post of duty without the consent of the district ranger unless it be to go to a fire

located in a near-by zone for which he is responsible for suppression, or to make emergency telephone repairs in accordance with his written instructions.

2. ACCURACY IN LOCATION

Every available means for assuring accurate location of fires will be provided.

Inaccurate location resulting in misguidance of suppression forces and causing loss of time when time is money must be forestalled by every possible method. Adequate finding apparatus will be used. It will be kept in proper condition, constantly oriented and checked.

Complete familiarity with every peak, ridge, valley, stream, or other landmark plus information as to burning conditions will be required as an aid and check on detection by mechanical means. It will usually be the basis of initial notification of the discovery of fire to the suppression forces to be followed by more accurate location through the use of fire-finding apparatus.

3. SPEED IN INITIAL REPORT

It is of prime importance that the suppression forces responsible be given immediate notice of the occurrence of a fire, day or night, so that the mobilization of these forces can be started at the earliest possible moment.

More than one fire.—Where several fires are sighted at the same time, day or night, they will all be reported in rapid succession. The most dangerous appearing fire will be reported first. Report will include statement of lookout's observation as to comparative danger of the several fires.

Outside fires and false smokes.—All fires in or near the forest will be reported to the officer responsible for suppression, giving such details as possible. The dispatching officer will use such other means as are available to supplement the information. When smoke is seen in indirect or blind areas, immediate report should be made of conditions as observed, so

that the ranger or other dispatching officer can take necessary steps to secure more accurate information. This also applies to so-called false alarms, and any suspected smoke will be reported at once. Lookouts should be advised of any known false smokes, and all permanent false smokes will be shown on the finder map.

Communication failures.—Call for immediate action. They will be forestalled in so far as possible through adequate maintenance and constant testing during fire weather. Forest officers will always be on the alert to detect trouble in the communication system. Written instructions to lookouts and guards will provide specific things to be done in case of communication failure. If failure occurs just as a fire is sighted every effort will be made to get the initial report to some members of the organization for relay. Failing in this, the detecting officer will test his own phone in accordance with written instructions. If the trouble is not in the instrument, he will leave at once equipped with repair tools and extra wire and proceed along the phone line to the nearest point where he can report the fire and the existence of communication trouble either by phone or messenger. If he has located the trouble and can make repairs with but little loss of time, he will do so. If not, he will return to the lookout at once.

Time standards.—In order that reporting practice be kept fully equal to the responsibility it carries, it is necessary that certain minimum requirements be observed.

Five minutes is the standard for the report of fires direct from lookout to dispatching officer, where Forest Service lines only are involved, and 15 minutes when part or all of the line is commercial line. When several fires are discovered at once, not over two minutes will be allowed for each additional fire. When the message must be relayed to another office, or where supplemental reports are necessary, an additional five minutes' time will be allowed for each relay or supplemental report.

4. DETERMINATION AND REPORT OF SUPPLEMENTAL INFORMATION

PRINCIPLE 2: Completion of the picture: Getting fuller information (*the best obtainable*), and calculation of the length of line to be built and mopped up in the first work period.

The detecting officer's report is not complete until he has supplied all the information available at the time and made a written record of it. A check list of full information needed will be kept in a prominent position by the detecting officer's telephone. He will report verbally the information on this check list and then make a written record of the report. Form 1-R-7 will serve. The same record will be kept on the dispatcher's desk sheet. It will contain:

- a. Tower or station reporting.
- b. Name of person reporting.
- c. Location of fire.
 1. Azimuth or line reading.
 2. Distance.
 3. Reference to topographical features.
 4. Reference to transportation system.
 5. Cross reading from another lookout point.
- d. Time fire started—guess or known.
- e. Time first sighted.
- f. Present apparent size.
- g. Wind conditions—direction and velocity.
- h. Probably cause—known or suspected.
- i. Number of men needed.
- j. Action taken.

A record in writing of subsequent progress reports will be made by the detecting officer as conditions of the fire warrant, as called for by the officer responsible for suppression, or at stated or prearranged periods, and will include:

- a. Rapidity of spread.
- b. Any change in wind, weather, etc.
- c. Apparent status of control.
- d. Any other data.

This information will be recorded on the back of Form 1-R-7.

The lookout will report and record as complete a picture of the situation as possible to the man or men responsible for going to the fire.

The ranger, guard, or warden by whom the report is received will add to this report any information which he, being closer to the fire, may have.

When the lookout report is not adequate for the definite location of the fire, steps will be taken to locate it definitely.

Action by the officer receiving the report will be:

a. Call another lookout for cross sight.

b. Phone person nearest to probable location for report.

c. If phone connections are not available in vicinity of fire, dispatch a messenger to locate it and report back, if possible, before crew leaves for fire; otherwise messenger will meet crew en route and give definite directions.

Failure to secure complete information as to the definite location of a fire should not cause unnecessary delay in dispatching crews. Plan to supply definite information to them en route.

With all the information at hand, the best obtainable, he will calculate the length of line to be built and mopped up under conditions at the fire during the first work period. He will figure, in other words, the size of the job ahead to be done in a certain time, and dispatch man power, including competent leadership, and equipment that is adequate to suppress the fire.

5. QUICK GETAWAY

PRINCIPLE 3: Dispatch of the most promptly available, worth-while man or men at once, competently instructed.

It is essential that someone get started at once. Minutes count. A few men on the job at an early moment may save many acres later. The best men promptly available will be dispatched first. They will go equipped as follows:

Minimum outfit first man will take to fire:

Afoot.—Consists of 1 raking tool, 1 standard ax, 1 water container, and 1 emergency ration outfit (three meals), with a lantern if night travel is necessary. If other equipment is available, and there is probability of his securing the assistance of another man en route, he will add a tool and rations for the additional man.

By automobile.—If first man leaves for fire in an automobile he will carry standard equipment for one crew.

Minimum outfit the first crew will take to fire :

The first crew will take a complete set of tools and equipment and provisions sufficient for one meal.

Presence of incendiarism.—The occurrence of incendiary fires, whether day or night, one or more at a time, indicates an emergency condition, and the apprehension of the incendiary is of the first importance. To this end the best qualified man available will be dispatched at once. If he be the officer receiving the report, he will leave at once, assigning the responsibility of dispatching suppression crews, notification of follow-up, requesting assistance of peace officers, or receipt of subsequent reports to a well-qualified person.

If a solitary officer without assistance receives such a report, he will immediately communicate with the suppression organization by the best means available and leave for the fire, giving priority to apprehension of incendiary over immediate attack.

6. MUSTER AND DISPATCH OF NECESSARY ORGANIZED SUPPRESSION CREWS

PRINCIPLE 4: Prompt muster and dispatch of organized suppression units, including grub for at least one meal, on basis of calculated probabilities, with follow-up made certain as, and if needed, men, tools, camp equipment, and grub.

Having started what might be termed the best available skirmish or scout crew ahead, the immediate next job is the muster and dispatch of shock troops or main body of the suppression force in sufficient numbers to cope with the situation as calculated from the report and other available information.

The size of the crew to send will depend upon the size of the fire, topography, ground cover, accessibility, weather conditions, distance, imminent danger, and availability of competent bosses. The size of the crew will always be ample for rapid progress and quick and effective control, but not so large as to entail unnecessary expense. A large, poorly managed crew, without a competent foreman, is a hindrance to orderly progress, and results in unjustified expenditures. Requests for men by inexperienced officers will be carefully checked.

Crews will leave completely equipped and with grub for at least one meal.

7. FOLLOW-UP

Follow-up will be provided for in every case. It may not be needed, but it will be made available if and when needed. The dispatch of needed man power need not be delayed for the purchase of grub, assembly of extra tools, tentage, and bedding which may possibly come from a distance. The main fire fighting man power should get under way promptly, depending on the follow-up crew to provide as above. Men for replacements in the ranks of fire fighters may be needed.

Unless it is definitely known that follow-up will not be needed, or can be called for without loss of time, it will be dispatched along with or immediately after the suppression force.

The officer dispatching follow-up will make sure that it will reach the fire without undue lapse of time. If the fire is difficult to locate or there is otherwise any chance that the follow-up may go wrong, one of the following methods will be used:

a. Send guide to lead follow-up to the fire.

b. Prepare definite, detailed, written direction.

Additional follow-up.—The district ranger or other officer directing the suppression operations will decide the necessity for and degree of follow-up and replacement. He will take into account the following and any other pertinent factors:

Reports from the fire line.

Size of fire.

Wind conditions.

Type of cover.

Humidity and dryness.

Topography.

Values at stake—danger in general.

Size and condition of original force.

Seasonal conditions.

Weather forecast and probable daily changes.

Follow-up and replacement may be provided by making use of any of the following resources:

a. Warden and crew from adjoining area.

b. Distant construction, survey, or acquisition crews.

c. Special crews of proven worth, though located at a point remote from the fire.

d. Railroad section crews.

e. Labor agencies.

f. Per diem guards.

No more follow-up should be sent to a fire than can be adequately bossed, equipped, and subsisted.

Should, for any reason, needed follow-up or replacement fail to arrive after a reasonable lapse of time, the fire boss will dispatch a messenger with specific instructions, to the end that the help required be secured with the least possible delay.

8. THE FIRE BOSS

PRINCIPLE 5: Dispatch of best available fire boss to the line. (*District ranger or other forest officer if possible.*)

It is relatively easy to buy good fire labor. It is difficult to get good fire brains. Every fire needs the best man in charge that can be secured.

The best available fire boss should be dispatched at once. If a better one can be gotten later, he should follow in with definite instructions to relieve the first man of responsibility. The district ranger or other qualified regular forest officer should be dispatched if possible. The fire boss will take active charge of

the fire. Messages and transportation of supplies and men will be handled by others under him.

9. TRAVEL TO FIRES

PRINCIPLE 6: Continuous travel—day or night—en route to fire.

Travel to fires will be continuous day or night. Speed with safety will be the rule and care will be taken not to exhaust men before arrival. Reckless driving of motor equipment which may result in delay or human injury from accidents will not be countenanced.

As a rule the shortest route in point of time will be followed, but longer routes which will result in arrival with organized man power may be used if, in the judgment of the dispatching officer, the loss of time is justified.

Travel time standards.—The minimum requirement for day travel is 10 miles per hour by automobile, 3 miles per hour on horse, and 2 miles per hour on foot. For night travel, 10 miles per hour by automobile, 2 miles per hour on horse, and 1½ miles per hour on foot. These standards are reasonable and performance will be checked against them. Failure to comply with these standards will call for explanations.

Recognizing that a large percentage of fires are incendiary and that many of them originate along or within short distances from the network of roads and trails which thread the forests of the region, steps will be taken as funds are made available to improve and maintain the condition of such routes of travel, so as to make possible better speed over them, with the objective in mind of one hour as the maximum elapsed travel time to fires. Travel will be continuous except as interrupted by causes over which the officer has no control.

Means of travel.—The use of motor equipment in transporting men and supplies to fires will be the general practice except in cases where control time will be shortened by other methods of travel. Forest offi-

cers will be equipped for horse or automobile travel in accordance with region or forest requirements.

Where their purchase and maintenance is warranted, special motor equipment of the speed-wagon type is desirable. A suggested minimum equipment for such a vehicle is as follows:

Seats for 8 men.

Tools and equipment for 12 men.

Rations for 12 men for 24 hours.

Cooking outfit for 12 men.

25 blankets.

Tentage.

2 spray pumps.

Siren horn.

Where larger outfits are desirable, men should travel in passenger cars.

Meals en route.—Meals en route will not be supplied except when such action will reduce control time.

Lights.—All motor equipment will be provided with adequate driving lights. Proper lights for horse and foot travel are necessary and will be prescribed to meet the needs of local conditions.

To insure quick and effective fire travel, the following are some of the things in regard to a fire and to conditions which each man responsible for going to a fire will know:

a. Accessibility.

b. Topography.

c. Distance.

d. Route of travel.

(1) On foot.

(2) On horseback.

(3) By automobile.

e. Time required to reach fire by each method.

f. What method or combination of methods of travel is necessary to take the required number of men and the amount of tools, equipment, and rations needed.

CHAPTER II

CONTROL

This chapter has to do with suppression action beginning with arrival at the fire and ending with the final stopping of spread. It is divided into two parts:

1. Functions of the fire boss.
2. Methods and practices in control.

The success or failure of suppression action is more dependent upon the ability and leadership of the fire boss than any other factor. Upon his judgment as to methods employed, his strategy in outwitting the fire, his generalship in handling the available resources rests the solution of the problem. In order that he function to the best advantage it is of prime importance that he know everything that is going on. He must have all the available information all the time. Otherwise he works in the dark.

It is also necessary that he be entirely familiar with the various methods of checking spread. He must know what they are and where and under what conditions they can best be applied.

Fortified with knowledge of the particular situation at a given fire and with knowledge of the best methods and technique known for the control of spread, he is in the most advantageous position to exercise his talents of leadership and strategy. On the large fires the fire boss has no time to devote to manual labor. On small fires he may lend a hand in the pinches.

1. FUNCTIONS OF THE FIRE BOSS

Initial Attack.

PRINCIPLE 7: Immediate attack—day or night—at the apparent point or points of greatest danger.

Provision will be made for determining cause of fire before the evidence is obliterated.

Small fires.—When the total perimeter and plan of attack can be comprehended at a glance fires will be attacked at once where the results will most quickly bring the fire under control.

Larger fires.—When the total perimeter and plan of attack can not be comprehended at a glance fires will be attacked at the apparent point or points of greatest danger.

All fires shall be attacked at the point, or points, showing promise of quickest control, which ordinarily will be the head, or heads, and dangerous points on the flanks. The following points are to be considered in planning the attack:

1. Sections where fire is about to reach an area where control will become difficult, such as areas of brush, slash, or rocky ground.

2. Leeward sections toward which the fire is burning most rapidly and will not be checked by some natural barrier.

3. Sections or points where fire has worked or is about to work across some natural fire break, as a stream, bottom of a draw, a sharp ridge or road which is holding, or will hold, the fire at all other points.

4. Sections where fire will destroy valuable timber or reproduction.

5. Sections where fire is threatening Government land or lands of a cooperator.

Such sections should receive first attention. The fire boss will then proceed first of all to get accurate information about the problem at hand.

PRINCIPLE 8: Scouting fire—going around it—checking probabilities—recalculating the job to be completed before the next “burning hour”—determining its critical points.

The fire boss will get full information about the situation in the shortest possible time. If it is apparent that he can not get around the fire in a reasonable time, he should send the most reliable man or men to scout certain sections and report to him.

If accompanied by sufficient man power, the fire boss will take one or more crews with him on the

scouting trip and put them to work at newly discovered points of danger.

Upon completion of the scouting and receipt of all available information, the size of the job to be handled before the "burning hour" of the next day will be recalculated as a basis for revamping the plan of attack. Such a calculation will consider:

1. Location of critical points.
2. Length of line to be built.
3. Rate at which it can be built.
4. Nature of ground and cover to work in.
5. Existence of natural aids—firebreaks, streams, roads.
6. Method or combination of methods to be used.
7. Rate of spread.
8. Length of time before "burning hour" of next day.
9. Man power on the job.
10. Need for additional forces.

PRINCIPLE 9: Revamping plan of attack and reorganization on basis of principle 8, considering—

Adequacy of man power and other facilities, and means of getting reinforcements if required.

Subdivision of lines into sectors or sides and provision of sector bosses—reassignment of crews.

Establishment of camps near line, as necessary, to reduce walking time to practicable minimum.

Reinforcements.—If the size of the job is too big for the suppression facilities at hand, immediate action will be taken to secure reinforcements from follow-up or from second and third lines of defense forces.

In any event word will be sent out, written if at all practicable, giving a statement of the situation, and help if needed will be requested. A report from the front is of great value. Instructions for guidance of reinforcements to the proper point on the fire are essential. The establishment of a line of communication with the outside forces is important.

Sectors.—The plan of attack will involve the division of the fire line construction job into sectors. The work on each sector will be handled by a sector boss appointed by the fire boss. It is a cardinal principle that work on the most dangerous sectors will be headed by the best qualified and most reliable sector bosses. Man power in unit crews will be distributed to the sectors in proportion to the calculated load of work to be done on each, the most dangerous sectors to be manned first. To avoid misunderstanding, sector bosses will be given written orders and location of their sectors.

The fire boss will devote as much of his time as possible to leading the attack on dangerous sectors. On larger fires he will designate the best qualified man as assistant fire boss whose function shall be to aid in gathering information as to the progress on different sectors and as an understudy to the fire boss. It is of the utmost importance that provision be made for affording the fire boss an opportunity to get sleep and rest on those fires that extend beyond the first work period.

Camps and mess.—Will be provided for in the plan of attack if the calculated job ahead will last more than 12 hours. The fire boss will designate a camp and mess boss, giving him instructions for the location of base camps and spike camps. He will assign the camp and mess crew and indicate when the first meal is to be ready. Camps will be so located as to keep walking distance to a practicable minimum. (See Outline of Duties of Camp Boss, appendix.)

Completion of Control.

Having revamped the plan of attack and gone to work under the best scheme available, the fire boss has the large job of seeing that the plan is carried out effectively.

PRINCIPLE 10: Keeping informed at all times of conditions on all sectors, acting upon information from organized sources, or personal knowledge. (*Kill rumors.*)

The fire boss will keep himself informed at all times of conditions on all sectors.

Rumors.—First-hand reliable information obtained by personal observation or reliable reports from capable sector bosses only will be accepted. The use of written messages for all reports is important. No important action will be taken on the basis of unfounded reports or rumors. The fire boss will see to it that sector bosses do not act on rumors.

Sustained attack.—Will be maintained night and day until control is effected.

PRINCIPLE 11: Pushing a sustained attack—night and day—insuring closures of every section of line, and completion of back-firing, well ahead of advancing fire.

Watchfulness on the part of the fire boss is necessary to see that speed and thoroughness of line location and construction will insure closing with safety ahead of the advancing fire. Many a fire crew has been outflanked by the fire because location and speed of line construction were faulty.

Work should continue night and day until fire is controlled, mopped up, and entirely safe. At no time will a fire line be left unmanned until suppression is complete. On the Allegheny, White Mountain, and Monongahela Forests there may be periods at night when fires die down to such an extent that night work is not practicable, but this will be made the exception and the definite responsibility of the man in charge.

Narrow line.—Speed in safe closure ahead of the fire means less loss of acreage.

PRINCIPLE 12: Construction of narrowest line, including necessary back-firing, that will corral the fire in the least time; or use of such other methods as will minimize area burned and cost—mopping up always at the heels of line builders.

The building of too wide a line slows up production of length. Nice judgment must be used in line location and specifications of width to permit fast work with

safety and at the same time reduce acreage loss. Line must be built, but only well enough to serve the purpose—namely, to get a line around the fire which, including necessary back-firing, will stop spread in the shortest time, keeping in mind small area of loss and low cost.

Vigilance.—To thwart disaster from sudden changes in fire constant vigilance is necessary.

PRINCIPLE 13: Constant vigilance in detecting and snap in acting upon impending changes requiring shifts or expansion of forces—coping with each situation before it gets out of hand.

The fire boss will keep himself alert to changing conditions. Wind changes, sudden drafts, any factors causing fluctuation in direction or rate of spread will be quickly noted and acted upon snappily, providing for shifts or expansion of forces, or changes in line location to cope with the new situation before it gets out of hand.

Second line of defense.—In case of loss of line by blow overs or from any other cause a second line of defense will be thought out in advance and sector bosses advised and instructed. Forethought in meeting these emergencies is better than the inevitable confusion that results from lack of it.

Relief and rest.—Human beings can be worked under pressure for a limited time only.

PRINCIPLE 14: Provision for relief and rest of the fire boss and crews if the job—including final mopping up—is likely to overrun 18 hours.
(*Invariably, place fresh crews on the line at day break.*)

Shifts.—If the job, including final mopping up, can be completed in 18 hours, the crew will be worked to that limit, the fire boss taking care, however, to assign jobs so that the more arduous tasks are not handled by the same men throughout.

Should it become evident that the fire will run over 18 hours, plans will be made as soon as possible to organize the force into 12-hour shifts. When shift is

first started it may be necessary to have part of the original crew on the line for an extra shift of 6 hours or so while the others take a short rest. After this, or upon the arrival of follow-up, the 12-hour basis will be carried out.

On the shift basis it is all important for the fire boss to take such steps as necessary to conserve his own strength, delegating his duties to a qualified assistant during quiet periods during which he will secure rest so as to be on hand and fully alert during the more dangerous parts of the day.

Food and rest.—Coincident with the organization on a shift basis camp will be established where men can secure food and rest at regular intervals. One camp to each 25 men off shift is desirable, with cook serving warm meals every six hours, night and day, with lunches and coffee carried to the men on the line where necessary. Food at regular intervals is a controlling factor in the maintenance of morale—of greater importance even than comfortable sleeping quarters.

In order to avoid confusion it is desirable that crews be kept intact at all times and under their designated crew boss. To this end crews should be kept together both on and off shifts.

Where fires occur within one-half hour's travel of community centers or sources of labor supply, it may be desirable to allow shifts to go home for rest, provided dependence can be placed on their returning to work at the proper time.

Exhaustion of local facilities.—This will be foreseen by the fire boss and a call for outside help will be timed so that diminishing efficiency of local facilities will not permit the situation to get out of hand.

PRINCIPLE 15: Alertness to impending exhaustion of local facilities, and promptness in call for outside help.

The interdistrict and interforest organization may be called in. The fire boss will bear in mind that it takes time to bring up reinforcements, and anticipation of exhaustion of local facilities is necessary.

Written orders will be the rule where at all practicable. They serve the dual purpose of assurance of accuracy and of providing a record of suppression action.

PRINCIPLE 16: Compliance, within practicable limits, with the rule of written orders from bosses to subordinates.

The desirability of making written orders in duplicate will be recognized. Orders will be delivered to crew bosses.

Leadership.—The fire boss will be the fellow out in front showing the way, not behind driving others ahead of him.

PRINCIPLE 17: Leadership of the fire boss: Constant, steady, aggressive, assertive, alert and knowing—always on the job in advance of crews. (*This counts mightily in units of held line.*)

The fire boss is the man the suppression force looks to for guidance and expert generalship. On his toes, up and coming, seeing and observing everything—he will be on the job ahead of the crews with the work all lined out.

2. METHODS AND PRACTICES IN CONTROL

Methods of attack are divided into two classes:

(a) Direct attack—which embraces work directly on the burning edge of the fire.

(b) Indirect attack—which involves work at some distance from the burning edge of the fire.

Direct Attack.

The direct attack may be used only on fires where the rate of spread is slow and the heat is not too intense for men to work on the burning edge. Direct attack may be accomplished by:

1. Raking or sweeping burning litter back into the fire.

2. Beating out flames with sacks, swatters, pine tops, etc.

3. Use of water.

Combinations of the above methods may be used.

Indirect Attack.

The indirect attack is more commonly used. Hot, fast-spreading fires require attack at a distance to provide the necessary workable conditions and time to get a barrier around the fire. Several methods of indirect attack may be used on any given fire, fitting the best method to the terrain, ground cover, and rate of spread. They imply the construction of fire lines or the use of existing barriers as bases from which the spread can be stopped. Four common methods are illustrated here in all of which back-firing may be used as a means of stopping spread:

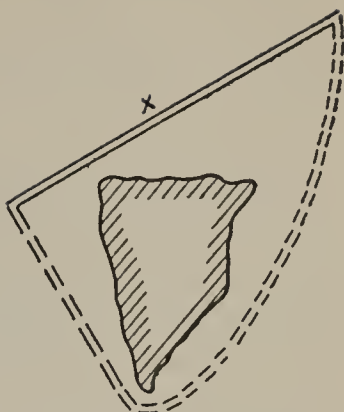
1. *Parallel method*.—Applicable to fires with fairly uniform outline and no pronounced points, tongues, or bays, and those which are spreading sidewise as well as in a forward direction and not very rapidly. The distance of the fire line from the burning edge will vary according to the rate of spread. This method is best for holding a fire down to small size, but should not be depended on in a heavy wind or with large fires in general.

2. *Oblique method*.—Occasionally a good-sized fire may be advancing rapidly with a fairly uniform front, thus presenting no distinct points or tongues which may be attacked separately. Under such circumstances it is decidedly dangerous if the fire strikes all points of the fire line or back-fire at the same time. It is very likely to cross at some point where the intense heat of the advancing front or the meeting with the back-fire may cause whirling drafts and set spot fires over the line. Using this method, the main fire comes up to the fire line at successive points instead of simultaneously and is more easily handled.

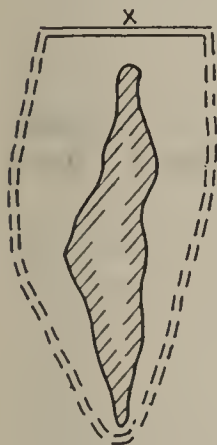
3. *Frontal method*.—This square-front method involves building a fire line square across the front of the fire at right angles to the direction of spread. It is particularly useful in the case of a long, narrow fire with no pronounced points.



Parallel Method



Oblique Method.



Frontal Method



Point and cut off Method

X Point of attack

— First fire line to be built.

== Later line to be built.

Edge of Fire.

Direction of Wind.

4. *Point and cut-off method.*—For the irregularly shaped fire with several advancing heads or points, this method is the most practicable. Concentration of attack at the points with provision for later line construction to cut off the bays is the scheme.

There are other methods of less common usage, and combinations of the various methods may of necessity be used on some fires.

Spot fires will be extinguished by direct attack.

Back-firing from a great distance will only be resorted to where extreme emergencies exist. Great rapidity of spread, the setting of numerous spot fires far in advance of the main fire, usually the result of high winds or heavy drafts, may constitute such emergencies. Such a method results in large acreage loss and will be employed only when some other method promising success by getting closer to the fire is impossible in the judgment of the fire boss. When used, absolute assurance of the holding of the base from which such firing is to be done must be apparent. The use of natural bases, such as roads, streams, lakes, fields, advantageously located trails, rock cliffs, or areas barren of fuel is recommended. When changes in burning conditions caused by shifts or dropping in wind, rise in humidity, or the coming of night permit attack closer to the fire, such opportunities will be grasped at once and burned area kept to a minimum.

Fire-line location.—The designation of the most advantageous location of fire lines is an art requiring nice judgment on the part of the fire boss in considering the values at stake, the method of attack to be used, necessary speed of construction, avoidance of flare-ups from firing, dodging snags and fire throwers, picking easy ground, use of existing barriers, and objective toward which line construction is headed. Lines will be the shortest possible and as free as practicable from tortuous windings.

The fire boss is responsible for locating the general route or position of the fire line in relation to fire and topography. In larger fires it will be necessary for

him to delegate this authority to a qualified assistant for the less critical portions of the fire.

Locations will be marked by cutting brush, setting poles against trees, or hanging pieces of paper along the route.

The general directions determined, the experienced crew boss will be responsible for the detail location on the ground.

Every forest officer will keep in mind the following points in fire-line location, and such other points as his experience has shown him to be the best practice :

1. Stay as close to the fire as heat will permit, i. e., use the direct method if at all practicable, and in the indirect method follow as closely to the burning edge as possible.

2. Avoid areas of dense underbrush where fire line construction is costly and line hard to hold.

3. Run lines around stumps, logs, brush heaps, snags, which are hard to remove in first construction and are a source of danger if close to the line.

4. Make no sharp angles in the line.

5. Avoid running lines straight up and down hill.

6. Avoid extreme slopes.

7. Avoid areas where rolling cones and burrs are a source of danger.

8. Catch fire on downhill if possible.

9. Don't let it cross a bottom and get a start up opposite slope.

10. Dry hollows are dangerous; build line above hollow toward fire.

11. Before dropping back to natural firebreak, be sure there is no chance of constructing a safe line for back-firing nearer the fire, thus saving a larger area of land. Man power, values at stake, and construction conditions should be weighed against possible chance of failure.

12. Be sure line is sufficiently in advance of fire to allow time to construct line through or across dangerous points and get it fired well back toward main fire, man power considered.

13. The lee side of a ridge is preferable to the windward side, on account of the back draft caused by heat of fire.

Specifications of line.—For all types construct the narrowest line which with back-firing where necessary will stop the fire with provisions for making it safe by burning and mopping up coincident with or immediately following line construction.

The object is to get a continuous, well-located, and clean line entirely around the fire in the shortest time possible, and with the least cost, followed immediately by such measures of widening as will insure safety.

The width of the line necessary will vary with several factors:

1. *Type of cover.*—Wider lines will be required in brush than in open stands.

2. *Wind.*—The necessary width increases with wind velocity. Where a 2-foot line might suffice in a 10-mile wind, a 3-foot line or more would be necessary in a 20 or 30 mile wind before line firing or back-firing would be safe.

3. *Slopes.*—On uphill fires the necessary line width increases with the slope, and in this case it is preferable to pull the raked material in the fire, first to assist in getting the back line started downhill, against the wind preferably, and to avoid an accumulation of inflammable material on the unprotected side of the line. On downhill fires the width necessarily decreases with the slope, and material should be pulled down away from the fire as is the case in most other instances.

4. *Humidity conditions.*—Where leaves are dry, light, and fluffy, a wider line is necessary to prevent burning leaves from blowing over the line.

Common failures in control are as follows:

1. Failure to make immediate attack.
2. Indecision as to methods or points of attack.
3. Failure to take advantage of periods of day when inflammability is low.
4. Failure to secure proper foreman.
5. Poor choice of equipment.

6. Failure to keep posted on all parts of fire.
7. Failure to anticipate changing winds, etc.
8. Construction of a line in front of a fire without burning down from extreme edge of trail.
9. Failure to do necessary firing of the line.
10. Careless firing of the line.
11. Failure to keep proper watch behind firing crews for break overs.
12. Carelessly constructed line.
13. Starting line too close to fire to allow time for completion and firing.
14. Failure to coordinate efforts of crews so that all men are working under one plan and toward one objective.
15. Poor line location.
16. Failure to foresee need for help and promptly call for same.

Equipment at fires.—Men work effectively only as they are equipped properly and as equipment is maintained in serviceable condition. As a preparedness measure the proper distribution and conditioning of tools and equipment is demanded. At a fire, provision for maintaining proper condition is required. The necessity for tool grinders, saw-filing kits, extra handles, files, rasps, etc., at the fire is apparent. Fire trucks will contain such maintenance tools and replacement supplies. The fire boss will see to it that tools and equipment are kept in shape at all times.

To avoid loss—

1. Care will be taken to avoid placing tools and other equipment where they will be endangered by the spread of fire.
2. All tools will be marked in accordance with standard specifications.
3. When tools are taken from a supply base, a memorandum covering kind and number will be made, and when returned to base a check against the memorandum will be made.
4. Responsibility for tools and equipment will rest with the fire boss.

Shortages of needed tools and equipment will be noted at once by the fire boss and additional tools will be sent for. Existing supplies of Government-owned tools will be requested first, but if not available within a reasonable time emergency purchases may be made.

Maintaining morale.—Maintaining high morale in the forces is essential to effective work. This may be accomplished by :

1. Inspiring leadership of the fire boss.
2. Well-understood delegation of responsibility and authority to eliminate confusion.
3. Provision for a practicable amount of personal comfort.

Inspiring leadership of the fire boss is essential. He is the big gun. Upon him rests the responsibility for the successful carrying out of the job at hand. (See principle 17.)

Elimination of confusion through well-understood delegation of responsibility and authority is required.

No fire-suppression force is better than the personnel of which it is composed. Success in fire fighting depends more upon the way in which the forces are recruited, officered, and handled, than upon any other factor. There is great similarity between fire fighting and military practices in the strategic handling of man power. No part of fire suppression is of greater importance than a completely worked-out system for crew organization, leadership, and dispatch. The results obtained on the fire line reflect the effectiveness of what has gone before.

On each fire some one man is the fire boss and has absolute responsibility and authority for the strategic handling of the fire. This man is usually the district ranger, a fire guard, or possibly a warden.

Each fire, other than a 1-man fire, calls for the services of at least one unit crew consisting of 6 to 12 men and the crew boss. Many times in small fires the crew boss is also fire boss, at least until a ranking forest officer arrives.

On larger fires, which can not be handled by a 1-unit crew, the first forest officer arriving on the fire

assumes the position of fire boss and will continue to act as such until the fire is suppressed, until he is relieved for rest, or until the fire is taken over by the district ranger. The supervisor or other staff officer arriving after the ranger has organized the work will seldom take over the responsibility unless it is very evident that vital errors are being made. Instead, he will act as advisor.

The fire boss will issue orders, written if necessary, to each crew boss, giving definite instructions as to the place of his crew in the attack, assigning to him a section of the line which will be definitely marked. It is then the responsibility of the crew boss to direct the efforts of his men in this section.

Practical personal comfort will be provided. Men work to far better advantage when their bodily needs are cared for. Good food regularly served and necessary rest are important factors in maintaining morale. There is no excuse for fire fighters "starving out" or losing their efficiency from unnecessary lack of sleep.

Regular mess is to be established on all fires that run for a period of 12 hours or longer. The member of the crew best qualified for such work will be placed in charge of the mess arrangements. The organization chart will list competent messmen.

The mess camp will be located with reference to the following points:

1. Convenience of the men—close to the fire line.
2. Water and getting in of supplies.
3. Safety and sanitation.

Meals at regular hours are important and must receive due attention. Men should preferably be fed at 6-hour intervals.

Cold food is satisfactory for use on small fires and as lunches on large ones, but it should be supplemented with hot coffee whenever practicable.

On large fires after the first meal, hot prepared food should be served at breakfast and at night at least. Lunches should be hot if practicable. Where men are working in groups, lunch should be taken to them; if they are working singly they should carry their

lunch with them when they start from camp or other point of dispatch.

Men on the fire line must be kept well supplied with water. It should be carried to them; do not allow them to go for it.

Canteens, 1-quart and 4-quart sizes, canvas buckets and bags, and back packs are necessary on all large fires. On all fires there should be at least one 1-quart canteen to each 2 men, one 4-quart canteen to each 6 or 8 man crew, or one water bag to each 10 men.

Men are usually desirable as water carriers, but some boys are exceptionally good. Avoid old men and irresponsible boys.

Shelter from showers and wind and a practical amount of bedding will be provided at rest camps.

Finance and time keeping—Policy.—Forest officers have a distinct obligation to fulfill in the accurate accounting of expenses in fire suppression. The fire boss, responsible for all activities on a fire, is also responsible for time keeping and all other accounting work on the fire. On small fires the fire boss will act as timekeeper, but where several crews are engaged it will be necessary for him to detail this work to a qualified assistant. The executive assistant may be dispatched to large fires to act as chief supply officer and head timekeeper.

Fire wardens often act as fire bosses on small fires and therefore are responsible for time keeping. They will be supplied by the ranger with time books or time slips for this purpose.

Procedure.—The fire boss or timekeeper will take the name of each man on the fire, his address, time he started to the fire, time of arrival, hours worked by shifts, and return travel time.

On small fires this can be kept in notebooks, Form 874-15 or 875. On large fires, when shift work is organized, the fire time slips, Form 874-15a, with detachable numbered stubs will be used. On large fires each time slip will be signed by the payee to avoid misunderstanding.

Immediately after a fire the district ranger will check all time slips for accuracy.

All other outstanding bills, auto hire, chuck supplies, and messenger service will be collected at once and forwarded through the supervisor's office for payment. The use of purchase order blanks, Form 877, will be required in the purchase of all supplies and services not covered by contract.

It is important that fire fighters' time be submitted immediately after each fire, as this is a big help in retaining the good will of desirable men.

Conditions of hire and rates of pay.—Fire fighters, crew bosses, and fire bosses will be paid an hourly rate in accordance with the Standard Instructions to Time Keepers on page 122 of the appendix.

On forests where local residents and citizens cooperators furnish the main source of fire crews a minimum wage of \$1 may be allowed.

The rate of pay must be fixed by local wage scales in each district and for each year as the price of labor changes. It must be so fixed that it will represent a fair remuneration for services performed, but not so high as to encourage the setting or prolonging of fires for pay.

Boys employed as water bucks or messengers will be paid according to their ability and value of service up to the standard wage for fire fighters. Cooks, flunkies, and others serving continuously through the fire will be paid on a daily basis.

Members of improvement crews will be paid in accordance with instructions given in the Administrative Handbook.

Necessity for accurate records.—Very frequently when trespass cases go to court for collection of costs of suppression the court will require canceled vouchers, receipts, and actual time slips as proof of disbursements, and forest officers will keep this in mind in assembling time and cost data.

Any time slips which show disproportionately long hours, vouchers which show irregular charges, or any feature not clearly explained by known facts will be

carefully investigated before submitted to the supervisor for payment.

Value of time of administrative officers will be computed from diary and from Form 26 reports at end of month.

3. FACTORS GOVERNING OR INFLUENCING THE SPREAD OF FIRE

Thorough knowledge of all conditions which govern or influence the spread of fire is of vital importance in formulating the plan of attack and in its execution.

Some of the things which each man needs to realize on the fire line are:

1. Leaves and litter in the fall are light, fluffy, and difficult to handle, but contain more moisture. This results in increased difficulty in marking and maintaining a perfectly clean line, but because of lower inflammability due to moisture in the leaves, catch overs from small sparks are less likely to occur.

2. In the spring, after winter rains and snow, the litter is more closely packed, but the top layer gives up its moisture more quickly on account of cell decomposition and becomes more readily inflammable. This results in greater danger of break overs and more difficult mopping up.

3. Periodic wind changes: Prolonged periods of high wind are more common during the spring than during the fall. Winds are apt to subside at sundown and rise again with sunrise.

4. Local drafts or breezes move up valleys and hollows during the day and down during the night.

5. Fire heats the air; hot air rises; there is an inrush of cooler air, fanning up the fire with an increase of oxygen.

6. Although there may be but little wind on the ground in a dense stand of timber, the velocity is apt to be greater in open spaces or above the tree tops, and should sparks reach these currents they may be carried considerable distances and start spot fires.

7. Back drafts: Although the wind is carrying the fire rapidly up a slope, it will probably be met by a

back draft on the lee side of the ridge top. This introduces two factors:

- a. The lee side of the ridge may be a favorable point of attack.
- b. When the back draft meets the prevailing wind, sparks may be carried to upper air currents, resulting in spot fires some distance from the fire line.

Fluctuation in the moisture content of the forest litter is a prime factor in regulating its degree of inflammability, which in turn influences the rate of spread of the fire and the degree of heat intensity. Each man must realize:

1. That it is the top litter that carries the forest fires and that under certain conditions the top layer may burn off and later fire will burn over the same area again.

2. That the top layer can dry out sufficiently within a very short time to carry a forest fire. Fires have been known to burn over the same area twice in one day.

3. That at night the moisture from the air may be deposited in the form of dew or frost.

4. That so close is the relation between the moisture content of the litter and the relative humidity of the atmosphere that a measurement of the latter at any time may be taken as a true index to the inflammability of the former.

5. That ordinarily litter has the highest moisture content between 2 a. m. and 5 a. m., and that fires are then at their lowest ebb.

6. That, normally, very little change in fire conditions occurs between 5 p. m. and midnight, and this period may be well used for resting parts of the crew preparatory to the concentrated effort during the period of low ebb (midnight to sunrise).

Steepness of slope and exposure are factors influencing the spread of fires. Each man must know:

1. The steeper the slope, the more rapid the advance of the fire.

2. Fires burn faster uphill than they burn downhill.
3. The flame is closer to and can more easily come in contact with material on the upperside.
4. The draft created by the fire itself is uphill rather than downhill, and that fires are slowed up at the tops of ridges.
5. Fires will burn sooner, more readily and rapidly, and are more difficult to combat on south slopes than on north slopes.

Temperature, except as it affects moisture, is not a material factor in the spread of fires in Region 7.

Ground material furnishes most of the fuel for fires in Region 7 and will therefore be given consideration. Each man must know :

Any brush, laurels, scrub oak, and sometimes young pines burn fiercely. When practicable, such areas will be avoided in the construction of fire lines. Fires are more easily controlled in leaves and litter than in grass, weeds, and brush.

At high elevations fire danger will exist earlier in the fall and later in the spring than at low elevations.

Lightning plays a part in fire danger as follows :

1. With heavy rains—little or no danger.
2. With light rains—increased watchfulness is necessary, especially the second and third days. Lightning may strike a snag or tree and the fire smoulder for one or two days before it starts the ground surface fire.
3. Without rain—begin at once to look for fires. Concentrate on high areas and along telephone lines.

CHAPTER III

MOPPING UP—PATROL—ABANDONMENT

Good practices in mopping up take their place on a scale of equal importance with other good suppression practices. The very best practices in control work are lost in application if poor mopping up follows. It is fully as important to hold a fire after it is controlled as it is to control it. No fire is safe until it is out, and by that is meant "black out" along its borders for a width of at least 200 yards.

Mopping up may be divided into two parts:

1. Work done during line construction and firing to effect temporary safety against crossing the line. This is handled always close on the heels of line builders and is termed preliminary mopping up.

2. Final work done after control to assure permanent safety. This is termed final mopping up.

Patrol is the continuing inspection of a mopped-up fire to assure check on the adequacy of mopping-up work.

Abandonment removes all man power from the fire after having been pronounced "out."

1. PRELIMINARY MOPPING UP

PRINCIPLE 18: Mopping up—the antiseptic of the fire operation—bearing the same relation to it as the antiseptic treatment of bad body sores—indispensable to the first relief—ever present throughout the entire course of treatment, and terminating with safety only when all possibilities of spread are "killed."

The moment fire touches the constructed line or natural barrier, whether from the main fire, back-firing, or line firing, mopping-up work starts in.

The responsibility for preliminary mopping up lies with the individual crew leader under the general direction of the fire boss. The crew leader has a certain section of line for the construction and mopping up of which he is directly responsible.

Selection of mop-up men.—The effective mopping up of burning material requires the services of crew members who have had experience and who possess judgment in this class of work. Quick recognition of dangers of fire crossing the line is essential. Judgment and snappy action in eliminating the most threatening danger first, skill and resourcefulness in extinguishing immediately small catch overs, sturdy physique to stand hard labor when subjected to heat and smoke are necessary. For these and other reasons the crew boss will select men with special qualifications for the preliminary mopping-up work. They must be men who can be depended upon to act quickly in an emergency, and men who will work steadily and to good advantage without the boss standing over them. Failure of the mop-up man may mean and quite often does mean complete failure of the first line of attack.

Work to be done.—As soon as fire touches the constructed line either coming from the main fire or from being set as a control measure, mopping-up starts. It is a cardinal principle that work will be done at the most threatening points, first making them temporarily safe before passing to less dangerous points. The job is to keep fire from crossing the line.

It is standard practice to have sufficient men on hot line to keep all of it in-sight all the time:

1. The first job is to eliminate as far as possible the chance of fire blowing across the line. Everything burning above the ground or throwing sparks must be cut down or completely watered-out to a safe distance from the line. The wind may be quiet at the time, but it may rise. Snags, "chimney trees," burning bark on standing trees, or tops must be made safe.

2. The next thing is to extinguish material burning on the ground. Throwing in burning embers, straightening burning logs up and down the hill so they will

not roll, watering out and dirting out stumps and smouldering débris, getting the line cut through to the mineral soil to a safe width for its entire length, burning out unburned patches of leaves and litter near the line, digging ditches to catch rolling pine cones and chestnut burrs, and cutting out roots that are burning or may burn across the line. In country where it is abundant water should be used, and water containers are essential mop-up equipment.

3. Keeping eternal vigilance for catch overs and spot fires and extinguishing them at once is mandatory. Each member of the crew shall delegate himself a committee of one to watch for such and to take action if discovered, shouting for help if he needs it. On large fires the use of special lookouts in tall trees or at some point where long stretches of line can be seen, or the detail of a man to watch for spot fires and catch overs is good practice when wind conditions and apparent insecurity of the line warrant.

4. Extremely high winds on exposed sites, where snags are prevalent, make it imperative that a sharp lookout be kept for spot fires beyond the line. They must be extinguished immediately by drawing men from the nearest patrol sectors.

5. If due care in line location has been followed, many of the most dangerous snags or "chimney trees" will have been dodged or felled. Those that remain must be cared for by getting them watered out or on the ground and extinguished or consumed. Danger from snags depends on height, distance from line, and wind.

6. The only checkmate for the burning root alibi is to see that inflammable roots are dug out of the line.

7. To get rid of the high wind alibi, always figure that a gale may come at any time. Get everything burning watered out or dropped to the ground and every spark out for a distance of at least 100 yards inside the line, not only on the leeward side of the fire but on all sides. The wind may be blowing in one direction and an hour later shift to an unexpected quarter.

Inspection by the fire boss.—The fire boss or his assistant will inspect the quality of preliminary mopping-up work being done, in his regular trips around the fire line. Faulty work will be called to the attention of the crew boss. Inspection is absolutely necessary and it is better to have too much than too little. It keeps men on their toes.

2. FINAL MOPPING UP

Final mopping-up work starts upon completion of the checking of spread. It is the job of making the fire permanently safe.

Organization of mopping-up forces.—Recognizing that mopping up and patrol is a specialized line of work, diligent effort will be made to identify men who are especially well qualified by nature and experience to supervise mopping-up crews. If none are available, promising men will be trained with this particular work in mind.

On small fires the mopping-up crew will be considered a single unit in charge of one forest officer or reliable assistant. The mop-up crew is best made up of men who controlled the fire. It is impossible to set up a standard as to what should constitute the size of the single crew for small fires. A hot line and a high wind in heavy brush or a section where snags, windfalls, and slash are prevalent require more man power than in open woods in quiet weather. The necessary man power per unit of length of line must be determined by the experience and judgment of the fire boss, but it will be a standard practice that sufficient patrolmen be used on a hot line to keep all of it in sight at all times. At the moment control is established and mopping up starts, the control crew and the mopping-up crew are identical. With due regard to safety and to cost, as many men will be gradually laid off as is permissible in the judgment of the fire boss. If mopping-up work is to continue for so long a time that men will get overtired, as rapidly as possible men will be rested near the line and held available for emergency work and to relieve over-

tired men until such time as reinforcements arrive. Do not send men home if they may be needed. As the work progresses the breaking-over danger is reduced, and as an increasing length of line is rendered safe men may be dismissed, but at no time will the size of the crew be reduced below a sufficient number to successfully extinguish any break overs. No line is safe until the fire is out.

Organization of mopping-up work on large fires involves such a number of men and so great a length of line that the subdivision of the force into crews under competent crew bosses is essential. It is important that the most experienced men and best qualified bosses be given the most dangerous sections of line. The concentration of forces on dangerous sectors is good business and the judgment of the fire boss must be brought into play in this part of the organization. Each crew will be given a certain marked section of the line to mop up and the dangerous spots will be pointed out. The crew boss will immediately acquaint himself with his assigned section and divide it into beats, giving one certain beat to each of his patrolmen, and put the best men on the dangerous beats. He will closely supervise the individual work of each man in his crew. The fire boss will keep himself free for supervision of the entire line. It is required that a prearranged plan of summoning aid from other sections of the line be understood between bosses should unexpected break overs occur. In this connection, no part of the line in immediate danger will be entirely deserted in going to the aid of other parts that have broken over. Where possible, reinforcements will be drawn from the least dangerous sections of the line.

Patrolmen will be instructed as to how often their beats are to be covered. By keeping them in motion continually, the tendency to bunch up or sleep on the line is eliminated. A constant check-up shall be maintained by the crew boss over his men.

Mopping up at night is highly desirable where the fire is "alive." Glowing sparks and embers can be

easily detected. Catch overs can be quickly spotted; they burn with less rapidity, and are more easily controlled. Leaving an unsafe line to care for itself overnight is inexcusable. However, if the fire is only smouldering, the probability of much nonproductive time at considerable expense is likely. Under these conditions men are prone to bunch, and even to sleep, when the boss is out of sight. Accordingly, only a false sense of security is too often the principal return from money invested in night work after the fire has been brought to that stage where the line is black and only obscure material may be smouldering here and there. Under these conditions, unless high winds are blowing or expected, the crew may be pulled, following a thorough inspection of the entire perimeter by the fire boss. As a precautionary measure carefully selected men will be posted for the purpose of watching for and suppressing break overs. Crews will be camped near the line and returned to work at the crack of dawn when, with renewed energy, mopping up may be effectively resumed.

Use of water.—Where available, water as an agent in mopping-up work is hard to beat. In the past, it has not been as effectively used as might have been. The relatively high cost of water conveying and spraying apparatus has stood in the way somewhat. The difficulty of getting water up steep slopes to dry ridges by man power has in some instances seemed out of line with the mopping up that can be done by other means.

The experimentation with hand pumps, power pumps, tank trucks and hose has demonstrated the practicability of using water to good advantage on nearly every fire in the region. This is particularly true for mopping-up work and to a less degree in the hot battle of stopping spread.

Whenever practicable, man power used in bucket lines to supply mopping-up crews will be supplemented by delivery of water by power. Power pumps can be hooked up in relay and water raised long distances.

3. PATROL

With completion of final mopping up to the point where the fire is apparently safe, final mopping-up crews will be laid off and a patrol crew take over the work. Patrol is added assurance against the possibility of faulty mopping up. The control crew will vary in size from one man to several, depending upon the length of line and the weather conditions. The patrol crew is not just a set of watchmen; they are investigators, looking into every possibility of the existence of burning or smouldering material within sight or within blowing distance of the line.

The patrol crew will be in charge of a patrol boss who will be responsible for the elimination of every last vestige of danger. Responsibility for each sector of line will be clearly defined. The limits of each sector or beat will be clearly marked on the ground. The patrol crew will be kept busy extinguishing smouldering material well inside the line, testing ash piles, stumps, and charred material for the existence of a last spark and for putting the fire in shape for final inspection.

4. ABANDONMENT

No fire will be abandoned until it is pronounced "out" by the district ranger or his authorized representative. Abandonment will not be authorized by the district ranger until he or his designated agent shall have made a complete inspection of the fire and has satisfied himself that it is safe to leave.

APPENDIX

CHECK LIST OF SPECIAL HUMAN RISKS BY CAUSES

1. Railroads:

- a.* Sparks from stacks } Locomotives or other coal-
- b.* Coals from ash pans } burning machines.
- c.* Matches, stubs, etc., from windows.
- d.* Burning right of way.
- e.* Activities of section hands, warming fires, etc.
- f.* Construction gangs—blasting.

2. Campers:

- a.* Hunters (fall and winter).
 - (1) Warming fires.
 - (2) Cooking fires.
 - (3) Overnight camps.
 - (4) Smoking out game.
- b.* Fishermen (spring and summer).
 - (1) Warming fires.
 - (2) Cooking fires.
 - (3) Overnight camps.
- c.* Motor tourists (spring, summer, and fall; winter far south).
 - (1) Roadside warming fires.
 - (2) Overnight camps at unauthorized places.
 - (3) Overnight camps at authorized places.
- d.* Hikers and horseback riders.
 - (1) Road or trailside warming fires.
 - (2) Overnight camps at unauthorized places.
 - (3) Overnight camps at authorized places.
- e.* Hitch hikers, tramps, and casuals.
 - (1) Road or trail side warming fires.
 - (2) Overnight camps at unauthorized places.
 - (3) Overnight camps at authorized places.

2. Campers—Continued.

f. Wagoners and truck drivers.

- (1) Roadside warming fires.
- (2) Overnight camps at unauthorized places.
- (3) Overnight camps at authorized places.

g. Galax pickers, shrub diggers, bee hunters, etc.

- (1) Warming fires.
- (2) Overnight camps.

3. Smokers:

a. Hunters (fall and winter).

- (1) Roadside and trail side risks.
- (2) Deer and bear stands.
- (3) Trap lines.

b. Fishermen (spring and summer).

- (1) Roadside and trailside risks leading into or out of favorite stretches of fishing water.
- (2) Stream banks.
- (3) Pond or lake shores.

c. Motorists—

- (1) Roadside risks—matches and burning smoking materials thrown from passing cars, trucks, and busses.

d. Hikers and horseback riders.

- (1) Risks along scenic trails or pass ways between communities.

e. Other miscellaneous users of the woods.

4. Débris burning:

a. Brush burners (spring, fall, and winter).

- (1) New ground in and near forest.
- (2) Fence rows and ditches.
- (3) Telephone and power line rights of way.

b. Sage-field burners (fall and early spring).

- (1) Stubble and cornstalk burning.

c. Tobacco-bed burners (early spring).

- (1) Beds right in edge of woods.

d. Grass burners (fall and winter).

- (1) Burning for local range.

5. Incendiary:

- a.* Burning to improve range (fall and winter).
- b.* Burning to kill beetles.
- c.* Spitework.
- d.* Lawlessness.
- e.* For a fire-fighting job.
- f.* To draw forest officers away.
- g.* Moonshiners and their customers.

6. Lumbering:

- a.* Logging locomotives and other coal or wood-burning machinery.
 - (1) Sparks from stacks.
 - (2) Coals from ash pans.
- b.* Burning rights of way or mill sites.
- c.* Mill stacks.
- d.* Sawdust and refuse piles.
- e.* Warming fires or smoking by the woods crew.
- f.* Road construction—blasting.

7. Miscellaneous:

- a.* Bee trees.
- b.* Distillery fires.
- c.* Accidental fires—houses, barns, or other property burning; explosions, grounded wires, etc.
- d.* Outdoor washing.
- e.* Children's pranks.

CHECK LIST OF SUGGESTED ACTION DIRECTED AT COMMON RISKS

There are many persons who are either in favor of woods burning, or else see no harm in it. They can advance what they believe to be valid reasons for this attitude. Prevention work must reach these persons through direct personal contact. Every forest officer, new or old, must have at his command concrete arguments to effectively refute such reasons.

The following is a check list which will serve to keep these arguments fresh in the minds of forest officers:

- 1. Woods burning is advocated by some as a means to improve stock ranges.

Experienced stockmen have found that burning does not improve the range for the following reasons:

a. It kills the better species of grass.

b. It is not a fact that burning the range increases forage. On unburned areas new shoots are intermingled with the old and therefore are not discernible. Stock will do better if their early spring food consists both of new and old growths, because the content of the new grass is mostly water, lacks fattening qualities, and develops scours. Accordingly, cattle weaken and a higher death rate results.

c. The short stubble left after a burn causes cattle and sheep to have sore mouths.

d. Burning kills leguminous plants, pea vine, the wild oat, beggar lice, and the best of the forage plants.

e. Hog ranges are greatly depleted through loss of mast, and hogs running on burned areas are subject to disease of the lungs by inhaling fine ashes.

f. Burning increases the stand of briars, which injure the quantity and quality of the wood crop.

g. Burning brings in inferior and worthless species of brush.

h. Ashes cause sheep itch.

2. Woods burning reduces loss by distribution of ticks, bean beetles, and boll weevils.

This argument has no foundation, as shown by the following indisputable facts:

a. Ticks are more numerous in open, burned woods, exposed to the sun than in virgin forests.

b. Dipping is the only method known to control ticks.

c. The bean beetle hibernates in uncultivated parts of the field, in overgrown fence corners, and in small crevices in buildings, not necessarily in the woods. In fact, by far the larger percentage hibernates near cultivated country. Woods burning could, at best, reach but a small percentage and the damage done would many times offset any small imaginary advantage.

d. The boll weevil also hibernates near the cotton fields and not any great extent in the woods. The worst known ravages by this insect are in the Texas

cotton fields where there are but few remaining forests.

The quail, or bobwhite, is the greatest natural enemy of the boll weevil. Woods burning destroys the nests and young of this natural enemy and gives the boll weevil even greater advantages.

3. By some misguided and misinformed sportsmen it is intimated that woods burning improves hunting.

It will be of some effect to inform them as follows:

a. Burning destroys the nests, eggs, and young of game birds, fire occurring in its worst intensity just when the ground-nesting birds are nesting.

b. Burning destroys the natural cover for deer and other larger animals. These animals will not stay in a burned area.

c. It is impossible to track an animal in a burned area, and dogs can not follow the trail.

d. Fires destroy the food for game animals and birds.

e. The resultant stunted growth which follows a fire makes trails through the woods difficult and dangerous and makes bird hunting almost an impossibility.

4. There are many people who have an indifferent attitude toward forest fires—conditions resulting from lack of information and failure to understand the principal damages involved.

This condition can be largely offset by stressing the following facts:

a. Any fire damages mature timber to the extent that both quality and quantity are reduced.

b. Young timber is destroyed outright, thereby reducing future supply of timber.

c. Forest fires are a most fertile cause of local timber shortage, resulting in higher timber prices and high freight charges.

d. Fires destroy the natural ground cover, which retains moisture, and cause unequal run-off. Freshets during the rainy season and dried stream beds during the summer result, and frequently farm land is damaged by floods.

e. Fires impoverish the soil by destroying the leaf cover, which is the natural fertilizer.

f. Fires destroy the attractiveness of the forest, and thus we lose recreational use.

g. Sediment and ashes from burned areas kill fish.

h. Fire reduces the vitality of trees and scars them, making them liable to insect and disease attack.

i. Fires destroy great quantities of fuel wood.

j. Charred wood is not accepted as poles or ties.

k. Valuable herbs and roots and berries are destroyed.

l. Fire reduces revenue of a community by loss of employment in woods work.

m. Fire reduces revenues to county and State by reducing taxable wealth.

n. Fire reduces receipts from national forests and thereby reduces county and State revenues from the 25 per cent road and school fund and the 10 per cent road and trail fund.

o. Forest fires destroy fences, domestic stock, buildings, and often lives.

p. It is recognized that where fire is kept out of the woods there is a period of years when the risk is somewhat increased, but this is confined to a period of from 5 to 10 years, when the risk again decreases and reaches its minimum in old mature stands.

LAW-ENFORCEMENT PROCEDURE

Each man in the field must lose no opportunity to get conclusive evidence on every fire, apprehend guilty parties, and take them to court. Concerted action along this line will do more to bring desired results than any other move we can make. Before the fire season opens it is advisable to make it generally known to the public that we intend to enforce the laws without fear or favor and that there will be no distinction made between the man of prominence and the poorer, less intelligent class who may be guilty of similar offense. Every man must know the law, both State and Federal, and be prepared to act

promptly under either, as may be for the best interests of the service. Quicker action usually can be had in State courts and a great many offenses can be handled with greater expediency under State laws.

Placing Responsibility.

To bring to justice those responsible for fires upon the national forests is as necessary a part of forest protection as to put out the fires. Immediate starting of the investigation and speed in its conduct are essential, since clues which might lead to the perpetrator may easily be obliterated by fire fighters.

Investigation.

The first man or men at a fire must either take up the hunt for clues or insure that these will not be destroyed. While fires should not be allowed to spread because of search for clues, the first man at the fire should spend a few minutes looking for clues and preserving them. This work can continue when help arrives or after the fire is under control.

Equipment.

Investigation equipment must be ready, with that of suppression, in advance of starting, so that no time need be lost in getting it together or something essential omitted because of haste. It should include a Forest Service notebook, a map of the forest, and a few sheets of mapping paper for local sketches, with the necessary pencils, etc., and a rule or tape for measurements.

Starting Out.

Get all the information you can before starting, or on the way, and on the basis of the best hunch you can form, plan what to look for and how to tackle it. This will often save time when you get there; but take care not to let this preliminary hunch grow into a cocksure preconceived theory which will prevent your taking the facts on the ground at their face value, regardless of whether they agree with your previous hunch or not.

At the scene of trespass.

In trespasses other than fire there is less danger of others spoiling the clues. At a fire, however, only extraordinary emergency should prevent the first man on the ground from spending a few minutes looking for clues. In any case, fire fighters must be kept from crowding around the fire until the ground has been looked over for clues. Make fire fighters stop horses and keep off the trails themselves for at least a hundred yards from the origin of the fire until this has been done. Note carefully people met on trails, with time of meeting. Keep your ears open for remarks of fire fighters who may know how it started.

What are clues.

Anything is a clue which has any connection with the offense of its author. Tracks, camp fire, or lunch remains, "plant" used to set off a fire, blanket, or other threads pulled off by brush or trees, hairs (animal or human), gun shells, scraps of paper, or anything else left by the offender are examples. Consider everything as a clue which can not be accounted for without reference to the offense. Nothing, however, is really a clue until it can be connected with the deed. This often requires hard thinking.

How to search.

On arriving at the scene, first try to locate the critical point; for example, the origin of a fire. If the point of origin is not evident, don't jump to conclusions; an incendiary or other criminal does not do the obvious thing, if he has any sense. Unless clues are immediately apparent, examine the area carefully. Do this on a definite system. Cover the ground in circles, widening the circles each time, but keep them close enough together to be sure that every foot of ground is covered. It helps to drop markers, to show where each circle ends.

Record of work.

Write down in your notebook a record of everything found and done, with the time of the record and

of the occurrence recorded. Describe everything found. Draw a map of the area, showing the location of every essential point; indicate the direction of streams and of travel of the suspect on trails, by means of arrows.

It takes time to record everything in detail in a notebook, but it must be remembered that cases of any difficulty may have to be taken up by someone else after you have begun them. He will know only what you can turn over to him as to the previous part of the case. If you haven't it recorded in your notebook you will almost certainly forget points that may be of importance. And even if you do not, your work is likely to be of little value in court unless you have a record of it.

Handling Evidence Material.

On all objects found the finder must put a private mark, in a hidden or inconspicuous place, by which he can identify it in court as the identical object found. All objects which it may be desired to use as evidence should be guarded with the utmost care, so as to avoid possibility of their loss or their being purloined by the defendant or his sympathizers.

Figuring Out the Case.

The only way to make progress is to use every clue found to build up your idea of exactly how the offense occurred. Build your theory absolutely on the facts as found, and do not a preconceived theory make you refuse to accept the evidence of new facts which do not agree with it. The latter is very common, but it is fatal to success. Whenever anything is found, ask yourself (*a*) what does this fact mean, (*b*) on the basis of facts to date, if I were the offender, what would I do next, (*c*) what instructions, if any, are there which will help me in respect to this situation? Stack up your case anew every little while on the basis of everything learned to date.

A court must have a complete chain of evidence, both as to facts and the proof that they are facts. To be complete, a case must answer the following ques-

tions: (1) What was the offense? (2) Where was it committed? (3) When was it done? (4) How was it accomplished? (5) Who did it? (6) Why did he do it? Memorize those six words—what, where, when, how, who, why. Apply them frequently both to your theory and the facts so far established. This will be of the greatest help in planning what remains to be done.

That which must be proved is also affected by the nature of the offense and the law governing it; for example, whether the offense was wilful, careless, or accidental; and if done by an agent, as a herder or a logger, whether his principal can be held for it. Whenever anything is found, think also what will be necessary to establish the identity and authenticity of this, if needed as evidence in court. Supporting or corroborative evidence may be necessary. A witness to the finding of important evidence is also invaluable. Now is the time, by getting everything thus required, to save the trouble of having to work it up again.

Special Clues, Tracks.

Tracks are among the most important clues. If a fire was set by human agency, a man walked or rode there to do it. He may sidestep or cover up tracks in the vicinity of the offense, or they may be burned over or obliterated by others. Farther out, he will settle down to normal gait. If no tracks are found at or near the origin, widen out. Begin the wider search at the most likely points, but until the tracks are found, conduct the search on a rigid system, so that no area will be overlooked.

In identifying tracks a careful study of details is essential. Dimensions and shape of imprint, nails, seams, creases, or any other distinctive marks, wear, repairs, angle between the feet, etc. Other facts may be often learned from tracks, such as the person or animal that made them (pointed-toe city man's shoes, horse shoes versus mule shoes, etc.); whether the person was drunk or sober; carrying a burden or free

(the feet are wider apart, steps shorter and more unsteady with a burden); or the existence of bodily defects (the steps are shorter on a lame leg, an injured knee or hip twists the foot track, etc.). Speed may be approximately shown by the degree of slide at heel, depth of heel edge and toe edge, length of drag at toe and distance between tracks. A confidential talk with the local shoemaker or blacksmith, if there is one, will often give light on the ownership of shoes which made a peculiar track.

The age of a track is shown by the sharpness of impression, by the moisture and color, whether leaves and dirt lumps have fallen into it, or tracks of insects, birds, other animals or men yet crossed it, and by the condition of broken green twigs, etc. One of the best indications of age of tracks is the condition of manure dropped by animals. Whether a trail was made at night is often shown by the way it bumps into or makes detours around objects. Whether a horse was ridden or led may be shown by whether the trail passes under or around low hanging limbs.

Following tracks requires experience and skill. In dry pine needles, breakages or minute differences in color are often discernible on hands and knees, when the needles have sprung back to position and no trace is visible while standing. Tracks in dry grass also require close attention; barring wind, grass will usually show what impression is made until the coming of night dew, fog, or rain. Through brush a trail can often be followed by broken or skinned twigs near the ground when it is invisible on the ground itself. When a trail is broken or lost, circle ahead in the probable direction of the trail; stakes set by tracks found will help line up the course.

The direction of travel of an auto can often be told on earth roads by the pattern imprint of nonskid tires, which is steeper and more distinct on the rear side of each indentation; by the direction of skid on side slopes or against angling rocks or water breaks; by the jump (when speed is sufficient) off the for-

ward side of such obstructions, or on dropping into chuck holes; by the impact (wider tire imprint) on the forward side of chuck holes or against obstructions; by action in ruts, where in dropping in a wheel will run off the high side to a feather edge, while climbing out it will stay in the rut until side pressure forces it to climb out abruptly; by water or mud dropped on the farther side of stream fords or mud holes; by the deeper impressions due to standing, at stops in soft soil, the impression being more pronounced at its rear side; by traction slips in going up steep grades; or by the Y where a machine backs out from a roadside stop. Even if no one sign is conclusive, the sum of these gathered by following the track closely for some distance will in most cases lead to a sure conclusion.

Don't forget the necessity of preserving good tracks by housing them over, etc., so that they may be examined by another investigator, if the case should require more than your own work.

Interviews.

Interviews in connection with law enforcement should always be conducted as an official, especially when the person interviewed is an offender or one of his sympathizers. Familiarity harms much more than it helps; but always be courteous. Have a witness or witnesses to all such interviews.

Good interviewing requires ingenuity and hard thinking; no two cases can be handled exactly alike. A man who is reluctant to talk can often be brought to it by directing the conversation first along lines in which he is personally interested, even though this at first has no connection with what you want him to talk about. A little flattery also is often effective. Reluctance to talk, however, may arise from a fear that you are trying to implicate him in the case. Such a suspicion should be guarded against when it is unfounded. Antagonism can often be avoided by stating to a witness that you have been requested by headquarters, or are required by regulation, to get

the facts in the case, and will appreciate it if he can tell you anything about it—thus putting the matter on the basis of routine duty.

Let the person questioned tell his story once through in his own way. Build a mental picture of the story as fast as he tells it, since this will both protect you against his misleading you and will help you to get a better grasp of his statement for subsequent questioning. Then question and rehash until it is certain that he can not tell anything more of value. A person's memory can often be helped by talking about unimportant details connected with the event concerned or of what the person interviewed was doing on the day in question.

Write everything down, verbatim or as nearly so as possible. When finished read it to the witness, make any changes he desires in order to make it correct, and have him sign it and have his signature witnessed.

Rewards.

The agricultural appropriation bill authorizes the Secretary of Agriculture to pay the rewards outlined in Reg. T-2, shown on page 4-T of the Manual.

Unintentional Offenders.

Courteous treatment and an evident desire only to do one's duty are usually more effective than treating such offenders like common criminals, and will often induce them to "take their medicine" and not do it again. But the courtesy should be accompanied by entire firmness that the law must be enforced.

Prosecution.

Forest officers will familiarize themselves with laws applicable to the region in which they are located and will during the fire season carry in the field notebook printed extracts of the State and Federal laws which are provided for that purpose.

Civil Action, Collecting Costs and Damage.

Refer to the National Forest Manual, Trespass section.

Criminal Action.

Forest officers should become acquainted with peace officers and contact them frequently to make sure their attitude toward fire law enforcement is favorable and that they are familiar with the law and procedure in such cases.

Justices of the peace have jurisdiction for violation of State laws only and such cases as are taken before them are for criminal violations. Justices of the peace have no authority to attempt to collect the cost of fire suppression from the defendant. Our only recourse where voluntary settlement is not made is to bring suit for cost and damage in Federal court. Where this sum is less than \$50, because of crowded dockets we shall have difficulty in getting into Federal court, and it behooves us, therefore, to leave nothing undone to have voluntary settlement made.

CHECK LIST OF CONTACT AGENCIES

1. American Legion.
2. Association of fire chiefs.
3. Automobile manufacturers association.
4. Automobile clubs and associations.
5. Boy Scouts.
6. Camp Fire Girls.
7. Chambers of commerce.
8. City automobile camp grounds.
9. Clubs and fraternal orders.
10. Commercial distributing companies.
11. Filling stations.
12. Sporting-goods stores.
13. Hiking clubs.
14. Country stores.

PERSONAL-CONTACT METHODS OF APPROACH

Aside from the suppression of fires which occur within or threatening national-forest land you have no more important job than doing everything humanly possible to prevent fires from starting. Your preven-

tion job is dealing with human beings, your neighbors, and the stranger within your gates, in such a manner as to make them feel a personal responsibility for protecting the woods against fire.

In order to have material at hand and to serve as a reminder to you, the following suggestions for action on the different risks are made:

Brush burners.

Make personal contact with every individual in the district who has brush to burn. Approach each one as an individual along the best line. Don't make him mad. Tact and diplomacy accompanied by an offer of assistance or suggestions as to best methods usually win out. Remember the brush-burning folder *Take Care*. You can probably use it to good advantage. The day for burning should be carefully picked and fires ought not to be started before 4 p. m. This includes tobacco-bed burners. If necessary invoke the State law. Have him let a forest officer know in advance when burning is to be done.

Take the case of John Jones's new ground with its brush to be burned. Here is a risk easy to get at. What should you plan to do about it? Go to see him, of course. But before you go, think what kind of a fellow John Jones is. How had you best approach him to get the result you want? I wouldn't think that it would be sufficient just to ask him to be careful about his brush burning. He might be careful, or he might not be. He might think he was careful and yet let the fire get out. If you can interest him in the best methods of brush burning you will have done a better job. In other words, figure out beforehand just how you are going to tackle John Jones before you go to see him. You may have to treat him differently from some other chap who has brush to burn in the district.

Hunters and fishermen.

Try to register every man who goes in. Wardens and key men can assist in this work if they are fur-

nished with registration forms. See that each party going in signs the pledge and a word is said about why we are protecting the woods, particularly with reference to fish and game. Stop any fisherman or hunter found in the woods and request his permit. Get the message of care with fire across to him.

Posters which deal directly with the hunter and fisherman risk should be placed at points where such parties enter, where they camp, at deer and bear stands, and at other suitable places. Remember most hunters and fishermen are smokers. Try to reach them at camps.

Lumbering.

The local sawmill operation always needs attention. Remember it is not the mill that is responsible for fire. It is the men who run it. A convincing argument in this and other risks is the liability of an operator for suppression costs and damages if fire escapes from his outfit. It may not be hard to convince him that a little money spent in fireproofing his outfit is good insurance against loss of his property and against suit for damages to his neighbors'.

Consider Bill Smith and his teapot sawmill. Bill is another problem, a human risk. He may need still different treatment to get him to properly fireproof his mill. You may have to demonstrate to him that it will be money in his pocket to get the plant in shape. You might have to scare him a little. You know best how to get at it. Remember that it is the man and not the mill that is the risk. The mill will not set the woods afire unless Bill Smith or his helpers let it. Figure him out beforehand.

Smokers.

A hard risk to get at because it embraces a high percentage of people who go to the woods. A word to anyone seen smoking in the woods, the proper placing of posters designed to appeal to the smoker along trails and roads is good business. Closure against smoking on dangerous areas might also be tried.

The Incendiary.

An individual who is hard to reach. Study people. Most incendiaries are local folks and they set fire to the woods for some specific reason. Find out that reason. What is the incendiary's motive? If known, are we not in a better position to make an attempt to convince him of the error of his ways? Meanwhile, watch him. A law enforcement case tied to him may be a convincing argument if others fail. Emergency patrol in areas of suspected incendiarism helps.

Campers.

These folks may well be approached in a similar manner to hunters and fishermen. Require them to register. Good poster display at favorite camping spots helps. Fireproofing such localities adds safety. Assist them to pick good places, to locate the inviting trails and points of scenic interest. Courtesy may bring a response that a hard-boiled attitude might discourage. Size up campers, local folks, or visitors.

TANGIBLE DAMAGES FROM FOREST FIRES

These are injury to (1) soil, (2) trees, (3) water, (4) wild life, (5) beauty.

1. Soil.

Practically every forest fire burns on the ground.

Each fire consumes more or less of the layer of decaying vegetable matter, called humus, vital to the tree, shrub, and herb life which the soil supports. It destroys that portion of plant diet which is composed of proteins, carbohydrates, and fats, leaving an unbalanced ration of minerals and salts.

Plant life sickens and starves.—At the same time it removes the organic leaven which works in the upper layers of the soil, transforming it into a sponge-like, absorbent cover retaining food and water against run off, evaporation, and seepage.

Soil texture is ruined.—With food supply and texture damaged, productivity is lowered. Loss of soil productivity is the heaviest toll of the forest fire. Other losses may be replaced in reasonable time at

reasonable expense, but loss of productivity can only be built back through the discouragingly slow processes of nature.

2. Trees.

Each forest fire destroys trees. Even the lightest fire destroys some and damages others. The average forest fire on most sites kills most trees up to 1 inch in diameter on the area burned, regardless of species. This represents about eight years' patient growth. Many larger trees are killed. The per cent of mortality on a given acre increases in direct ratio to the number of little trees on it. The younger the timber the higher the death rate.

The association of trees which we call the forest is like the association of persons which we call the human race. If we kill off the children, what is the future of the race? If we burn up little trees, what is to become of the forest? The answer is simple.

Some day, not so far off, we will have an expensive task of planting trees on an impoverished soil and of trying to make them grow. If we eliminate the forest fire, Dame Nature will gladly do it for us.

To all this we must add the damage to big trees that have struggled through seering flames—scarred trunks, defoliation, injured roots—all of which result in retarded growth and reduction in value of the mature tree.

3. Water.

Controlled water supply is a necessity of life.

Uncontrolled water supply is a menace expressed in flood, drought, silting, and erosion.

The forest assists in the regulation of the flow of water in several ways:

a. It interrupts the beating effect of rain upon the soil.

b. It retards the sudden melting of heavy snows.

c. The spongy humus soil covering conserves moisture and retards run-off.

d. The roots hold the soil together.

There are other ways.

The effect of all these factors working together might be grasped this way: Take a bare table and tip it up at an angle. Pour a cup of water on the top. It runs right off. Now put a blanket on a tipped table and pour another cup of water. The water seeps in and works its way down.

Fire destroys the blanket.

4. Wild life.

Forest fires and wild life do not get along together.

Many furred and feathered creatures perish in each blaze. If the adults get away the helpless young are caught. The game birds with ground-nesting habits are heavy losers. Food and shelter for birds and animals both are consumed in the forest fire.

Repeated fires—and game leaves the country.

Fish life is endangered.

Stream shade is removed. Insect and herbaceous fish food is destroyed. The water carries ashes washed from burned hillsides. Streams lose their attractiveness.

Hunting in burned woods is poor. Game is scarce; dogs track poorly; charred brush and trees make nasty going; thickets of thorns and briers spring up.

Fire is detrimental to the conservation of game and fish and to the sports of hunting and fishing.

5. Beauty.

There is no beauty resulting from a forest fire.

Charred trees, blackened hillsides, fallen timber, all present a sorry picture. The flowering shrubs and herbs of the woods disappear. In the path of the forest fire we have blackened waste, desolation.

In a land justly noted for its beauty there is no place for the forest fire.

Summarizing.

Tangible damages from forest fires are injury to: (1) Soil, (2) trees, (3) water, (4) wild life, (5) beauty.

FIRE IS AN OUTLAW IN THE FOREST

MAP LEGEND

Present ranger district boundaries—Green crayon.

Proposed ranger district boundaries—Red crayon.

Organization, present—Green ink ; changes—Red ink



District ranger.



Assistant ranger, yearlong.



Administrative guard.



Fireman.



Patrolman.



Primary lookout.



Combination lookout smoke chaser (use separate symbol for each if two men are stationed at a lookout).



Per diem guard.



Cook.



Commissary clerk.



Tool cache—with number man equipment.



Telephone operator.

T

Location of telephone instruments.

QUALIFICATIONS OF LEADERS IN FIRE CONTROL

DISPATCHER

Knowledge of local conditions.

Ability to decide quickly and accurately.

Initiative—resourcefulness.

Perseverance—stick-to-it-iveness.
Experience and ability in fire fighting.
Dependability.
Organizing ability.
Methodical—able to keep accurate records.
Industriousness.
Must have phone connections.

WARDEN

Knowledge of local conditions.
Leadership—ability to handle men.
Experience and ability in fire fighting.
Community leadership—standing.
Ability to decide quickly and accurately.
Public spiritedness—willing to make sacrifices.
Dependability.
Organizing ability.
Perseverance—stick-to-it-iveness.
Optimism—not easily discouraged.
Physical fitness.
Initiative—resourcefulness.
Aggressiveness—determination.
Positiveness—ability to decide.
Should have phone by all means.

LOOKOUT

Keen eyesight.
Knowledge of local conditions.
Ability to decide quickly and accurately.
Initiative—resourcefulness.
Perseverance—stick-to-it-iveness.
Dependability.
Methodical—able to keep accurate records.
Industriousness.
Must have phone.

CREW BOSS

Leadership—ability to handle men.
Experience and ability in fire fighting.
Ability to decide quickly and accurately.
Aggressiveness—determination.
Initiative—resourcefulness.

Physical fitness.
Optimism—not easily discouraged.
Perseverance—stick-to-it-iveness.
Dependability.
Should have phone.

IMPROVEMENT CREW, FOREMAN

Leadership—ability to handle men.
Aggressiveness—determination.
Industriousness.
Positiveness—ability to decide.
Initiative—resourcefulness.
Physical fitness.
Perseverance—stick-to-it-iveness.
Experience and ability in fire fighting.
Dependability.
Organizing ability.
Should have phone.

LOOKOUT FIREMAN, FIREMAN PATROLMAN

Keen eyesight.
Knowledge of local conditions.
Leadership—ability to handle men.
Experience and ability in fire fighting.
Ability to decide quickly and accurately.
Aggressiveness—determination.
Initiative—resourcefulness.
Physical fitness.
Optimism—not easily discouraged.
Perseverance—stick-to-it-iveness.
Dependability.
Industriousness.
Should have phone.

KEY MEN

Community leadership—standing.
Public spiritedness—willing to make sacrifices.
Dependability.
Leadership—ability to handle men.
Organizing ability.
Knowledge of local conditions.

TIMEKEEPER

Methodical—able to keep accurate records.
Dependability.
Perseverance—stick-to-it-iveness.
Initiative—resourcefulness.
Industriousness.

CAMP BOSS

Organizing ability.
Methodical—able to keep accurate records.
Dependability.
Perseverance—stick-to-it-iveness.
Optimism—not easily discouraged.
Industriousness.
Initiative—resourcefulness.
Positiveness—ability to decide.
Aggressiveness—determination.
Knowledge of local conditions.
Leadership—ability to handle men.
Ability to decide quickly and accurately.

All important as is the framework, the officers of the fire-control organization, without men, crew members, it would be as ineffective as would be an army without squad members. Given the proper sort of supervision, it is not imperative that each crew member be a superman; it is, however, important that each member be a good man—the best that can be obtained or developed. Around each crew leader is to be developed a well-balanced, hard-working crew of from 6 to 10 fire fighters. Crew members should be chosen by the warden who is to be the crew boss and the ranger. The best qualified member should be designated as the assistant crew boss.

Crew members should possess the following qualifications:

Physical fitness.
Public spiritedness—willing to make sacrifices.
Perseverance—stick-to-it-iveness.
Experience and ability in fire fighting.
Optimism—not easily discouraged.
Knowledge of local conditions.

Aggressiveness—determination.
Initiative—resourcefulness.
Dependability.
Industriousness.

CORRELATION OF ROAD AND TRAIL AND FIRE-CONTROL ACTIVITIES

(This policy of the correlation of road and trail and fire control activities was approved by the Forester May 31, 1930.)

It is generally recognized that the man power employed by the Forest Service in constructing and maintaining roads and trails, is a vital factor in handling the protection problem. On many national forest units where a heavy construction program is under way, use of the man power employed on road and trail projects in expending and reinforcing the protective organizations during the occurrence of peak loads and as a second line of defense on suppression, has materially reduced acreage burned, damage, and suppression expense.

It is essential that the greatest freedom be maintained in the flexible use of the employees engaged on both the protective and road and trail activities. It is inevitable that some loss will be incurred in road and trail accomplishment. These losses are somewhat comparable to those suffered by private interests in or adjacent to the national forests when their organizations are used on suppression work.

Good practice includes the following:

I. In selection of projects consideration must be given to—

a. Need of facilities or projects and returns from investment.

b. Distribution by ranger districts or forests to provide man power for suppression purposes and expansion of protective organization.

c. Economies of doing the job, crews balanced, moving from job to job, etc.

II. Organization—

a. Machinery and man power should be correlated where substantial savings are involved so as to give the most miles for a given sum.

b. In so far as practicable, man power should be peaked during the fire season.

c. Where a factor in securing desirable personnel, key men on both road and trail and protection organizations should so far as possible be given early work so as to lengthen the period of employment.

d. Selection of men should be based upon several factors:

1. Ability as road and trail workers.
2. Ability to act as emergency guards and in fire suppression.

Other things being equal, factor 2 should be given high priority. Where skilled specialists are involved factor 1 must govern.

III. Equipment—

(a) Equipment of all classes purchased for road work should be used so far as possible exclusively on roads or on other protective improvement work except as needed on fire suppression.

(b) Both operating and depreciation mileage costs should be used in adjusting charges when road and trail trucks or other equipment are used on fire suppression. Where road trucks are habitually used for serving both road and fire-control organizations, either the first cost may be distributed or costs adjusted on a mileage basis. Fire-fighting tools should be provided for roads and other crews from fire-control funds and used for no other purpose. Emergency wire for use of road and trail camps should be paid for by the activity requiring the installation. Ordinarily use of road funds for road-camp use and fire-control funds for trail-camp wire appears to be a fair division under average conditions.

IV. Suppression—

Losses in road and trail work due to use of organization on fire suppression should be compensated

wherever possible. Suppression needs must govern where crews are needed on fires, but such crews in whole or in part should only be held for mop-up or patrol work when other equally competent and trustworthy men can not be provided at reasonable cost. Any compensation due members of such crews on account of rest periods made necessary by service on fire suppression should be paid for from the fire funds.

When, in order to get road or trail workers who will function effectively on fire work, it becomes necessary to pay a higher rate than would be necessary for strictly road or trail purposes, the increase necessary to get the type of men required is a proper charge against fire-control allotments and appropriate adjustments should be made.

TOOLS AND EQUIPMENT .

Suggested list—6-man crew.

- 6 raking tools.
- 1 ax, double bitted.
- 1 crosscut saw.
- 1 hazel hoe or mattock.
- 1 bush hook.
- 1 file, 8-inch.
- 2 buckets, canvas.
- 3 canteens, 4-quart.
- 1 hand pump (as funds are available for purchase).
- 2 lanterns.
- Time slips, notebooks, and pencils.

Suggested list—25-man crew.

- 10 potato hooks or pitchforks.
- 10 combination rake and cutting tools.
- 6 axes, double bitted, 3½-pound, handled.
- 6 saws, crosscut, 6-foot, handled.
- 6 hazel hoes, handled.
- 6 bush hooks.
- 6 files.
- 6 canteens, 4-quart.
- 12 canteens, 1-quart.

- 3 hand pumps.
- 8 buckets, canvas.
- 6 lanterns.
- 1 portable telephone.
- 2 miles emergency wire.
- 5 gallons coal oil.
- 1 torch, 1½-gallon tank.
- 3 pack saddles, blankets, etc.
- 12 bed rolls, complete with tarps.
- 1 25-man kitchen and mess outfit or 15-20 man outfit.
- 1 tent fly, 10 by 12, or larger.
- Time slips, notebooks, and pencils.

Satisfactory 6-man mess outfit.

- 1 shoulder strap.
- 1 canvas container.
- 1 pail, 10-quart.
- 1 pail, 8-quart.
- 1 frying pan, 8-inch.
- 10 plates, 10-inch.
- 10 cups, nesting.
- 1 knife, folding.
- 1 cake soap.
- 1 knife, paring.
- 10 knives, Army.
- 10 forks, table.
- 10 spoons, dessert.
- 2 spoons, table.
- 2 can openers.
- 1 kettle, chains and hooks.
- 2 towels, hand.
- 2 towels, dish.

MARKING TOOLS AND EQUIPMENT

In order to prevent loss from theft and as a means of ready identification, all fire-fighting tools and equipment should be marked or branded.

As a permanent mark, it is proposed that all metal tools be stamped "F. S." and that the handles be

given a coat of red paint beginning where the wood joins the metal and extending up 6 inches, as a means of easy identification. The red-band idea should become the trade-mark of fire equipment and should be used in so far as practicable.

Water bags, buckets, canteens, beds, tents, and all similar equipment should be stenciled "U. S. F. S." in letters at least 1 inch high, or marked with the regulation shield.

The "F. S." should be stamped at a specified place on each tool in order that a forest officer may know just where to look for it, and the committee is in favor of a standard system of marking which might be made service-wide. With this in mind, the following scheme is suggested:

The brand should be on the right-hand side of the tool when it is in use if there is only one way to use it. For instance:

1. *Shovels*, stamp on inside of right-hand corner.
2. *Pole axes*, right-hand side, middle of eye.
3. *Double-bitted ax*, either side, middle of eye.
4. *One-man saw*, right-hand side, close to handle, near the top.
5. *Two-man saw*, either side or end.
6. *Mattock*, either side.
7. *Hoe*, right-hand side.

The working out of such a scheme is only a matter of detail.

SUGGESTED RATION LIST

The following ration list has proven satisfactory for R-7 conditions. It may be varied for individual forests or ranger districts:

Six men, one day.

- 7 pounds bacon or corned beef.
- 5 pounds pork and beans.
- 2 pounds cheese.
- 5 pounds crackers, or 10 loaves bread.
- 4 pounds prunes, canned.
- 1 pound sugar.

- 1 pound coffee.
- 6 cans milk, small.
- 3 pounds jam, jelly, fruit butter.

Twenty-five man crew, three days, nonperishable supplies.

- 40 pounds bacon, standard brand.
- 1 pound baking powder, standard brand, in 1-pound tins.
- 12 pounds beans, navy, choice recleaned.
- 1 dozen candles.
- 20 pounds cheese, American, full cream, in 1-pound tins.
- 15 pounds coffee, ground, standard brand, in 5-pound tins.
- 10 pounds crackers, unsalted, in 1-pound cartons.
- 50 pounds flour, standard brand, in 25-pound cloth bags.
- 15 pounds fruit butter, assorted, in 1-pound containers.
- 40 pounds ham, standard brand.
- 15 pounds jam, assorted, in 1-pound containers.
- 5 pounds lard, pure, in 5-pound tin.
- 1 box matches.
- 24 cans milk, tall, standard brand.
- 1 case peaches, choice (24 No. 2 cans to case).
- 1 pound pepper, black, in ¼-pound tins.
- 1 case pork and beans, lunch size cans, standard brand.
- 25 pounds prunes, dried, fancy, in 25-pound box.
- 5 pounds raisins, seedless, standard brand, in 1-pound sealed tins.
- 10 pounds rice, uncracked, in 5-pound tin containers.
- 4 pounds salt, table, in 1-pound carton shakers.
- 30 pounds sugar, pure, cane, granulated, in 10-pound bags.
- 1 gallon sirup, standard brand, in ½-gallon tins.
- 3 cakes soap.
- 1 carton tobacco, smoking, standard brand.
- 2 pounds tobacco, chewing.
- 1 carton cigarette papers.

5 yards cheesecloth.

When put to use the following should be added :

75 loaves bread, baker's, wrapped (to be packed in bags).

50 pounds potatoes.

15 pounds onions.

50 pounds cabbage.

A PARTIAL LIST OF FUNDAMENTAL SUBJECTS TO BE CONSIDERED AT TRAINING CAMPS

A. A talk to the class about the purpose of the Forest Service.

1. Its aims.
2. What a plentiful supply of timber means.
3. Different forms of damage done to the forest by fire.
4. What such loss means to the community and to the country at large.

B. Fire plan.

1. Study section by section, giving full explanation of policies and reasons therefor.
2. Review of written instructions in same manner.

C. Maps.

Explanation of what the markings and characters mean with specific reference to the details of the map of each particular man's fire division.

D. Tools, equipment, and supplies.

1. Actual demonstration and training in ax grinding or filing; handling axes, mattocks, hoes, etc.; care of tools, standards of sharpness, etc.; use of compass and how to employ it in locating position of fires from courses reported by lookouts.

2. If packing of animals is to be a feature of the season's work, a course in loading an assortment of tools and food supplies.

3. If back pack is to be required on any particular job, a course in the assembling of equipment and food supply for a 3-day trip.

E. Communication.

1. Explanation of Forest Service and other systems of telephone lines as they apply to each guard's division.

2. Instructions on splicing wires, replacement of insulators, batteries, and use of portable phones.

F. Fire prevention.

1. Exhibit various types of fire warnings and other types of educational matter. Explain purpose and how each kind should be used.

2. Exhibition of a map plan for fire-warning posting of each ranger district and tributary country and how the guard will function in carrying the plan into effect. Detailed talk on the best practices to follow in fire-sign posting and necessity for destruction of old ones. A lecture on ways of distributing miscellaneous educational matter to the general public.

3. A well-planned talk to give each man a working idea of methods of approach to the camping public. Furnish each patrolman with an outline of subjects to talk about to people he meets along the road and on camp grounds.

G. Suppression.

1. Fake fire call and a timed ride with equipment or foot trip with pack of say $2\frac{1}{2}$ miles to an emergency fire for the purpose of impressing upon the men, first, the necessity for speed and going with full equipment and, second, the necessity for showing them how to do it.

2. Training in actual construction of fire lines in various types of cover or particular types of cover occurring in each guard unit. (This can sometimes be done only after a guard reaches his place of assignment.) This course to include such things as:

a. Width and depth of fire line.

b. Which side of line to cast débris under different conditions.

c. Cutting off all logs which project across the fire line.

- d.* Where fire line is necessary and where not.
- e.* Back-firing.
- f.* Lecture on various methods of attack and under what circumstances each method is applicable.
- g.* Why night travel and attack is required, including brief statement of reason why fires burn slowly at night and in early morning.
- h.* Where to attack a fire, including a statement of the advantage of getting a fire completely surrounded by a rough line quickly. The clean-up work to be done later.
- i.* What effective mopping up and patrolling of a fire line consists of; the cleaning up of all burning material near the line by rolling it toward the center, cutting off snags which menace the safety of the fire; putting out with water or covering up with dirt all stumps and logs which can not be rolled well into the burned area.
- j.* Cutting all roots of burned pitch stumps which extend across the fire line near the surface.
- k.* When a fire is safe for abandonment.

H. Law enforcement.

1. Explanation of Forest Service law enforcement policy with reasons.

2. Instructions of how to proceed to collect and preserve evidence including the importance of carrying a notebook to record specific time, place, persons, identification of objects, distance, weather conditions.

3. In certain cases how to proceed in criminal cases.

I. Post fire work.

1. Cleaning up camp and restoration of tools, supplies, and equipment to proper place and condition.

2. Ways of ascertaining areas of fire.

3. Report of preparation with reason for accuracy.

4. Time-keeping principles.

5. Method of paying fire fighters (local men).

J. Learning the units.

Learning the district—outline of exploration trips over each man's division. Outline should include trips into particularly difficult country. Trips over high points and deep canyons. Preferably some member of the regular force should accompany each guard over at least part of the exploration routes for the purpose of indicating to the guard regions of particular hazard, at the same time giving him a description of the hazard involved, and to point out to him various other features which have an important bearing upon his job.

Guards should be required to post fire warnings during the trip in order that the district ranger might later check, first, to determine whether or not the trips were actually taken; second, to use as an index the fire warning posting done by the guard as to what information he might have absorbed on the subject during the training period.

K. Care of quarters.

The doing of the various kinds of improvement work which might be assigned to each man during the season.

L. Course for lookouts.

1. Eyesight—test and care of the eyes.
2. Talk to give idea of lookout's place in the organization.
3. Explanation of use of instruments.
4. How to read a map.
5. Recording observation.
6. How to report and to whom.
7. How to judge and measure size of fires from observations of rising and density of smoke.
8. How to judge type of country in which fire is located by color of smoke.
9. How to judge wind movement by draft of smoke.
10. How to judge atmospheric conditions by action of smoke.
11. Importance of constant vigilance.
12. Importance of tab on progress of fire.
13. Care and use of telephones.

14. Detailed review of written instructions.
15. Outline of subjects to talk about to visitors.
16. Use of tourist registers.
17. Cooperation with other forest officers.
18. Care of quarters.
19. Need for exercise. Value of trips for water and wood.

STANDARD INSTRUCTIONS TO TIMEKEEPERS

1. Read carefully the instructions on the back of the time slip, particularly as to entries at midnight and noon hours. Follow these instructions literally.

2. Payment will be made for the actual number of hours upon which work was performed.¹ These instructions will be interpreted literally.

3. Time will not be allowed for hours men are separated from the crews because of slowness or any other preventable reason.

4. Travel time will be allowed as follows: Machine or horse travel will be calculated on actual time consumed in making the trip. Walking time will be allowed at the rate of $2\frac{1}{2}$ miles per hour unless a more rapid rate of travel is employed. In this case the actual travel will be allowed. Eight hours per day will be the maximum time allowed for any form of travel other than foot travel.

5. Men discharged for inefficiency or who quit before being released by a forest officer will not be given any travel time either going or coming, nor will they be furnished transportation on the outgoing trip.

6. Any employee being discharged or quitting after he has actually worked on a fire for 20 continuous days will be entitled to return transportation and all time allowances.

7. Any employee laid off or discharged for the purpose of decreasing the size of the crew is entitled to return transportation and time allowances.

8. Employees who are injured while engaged in official work are entitled to return transportation and

¹ With half-time allowances in accordance with par. 9.

travel time allowances in accordance with paragraph 4.

9. Crews held in camp awake or sleeping or held on the fire lines for reserve purposes when there is no regular work to do will be allowed half time only, and in no case to exceed the equivalent of a maximum of 8 hours for each 24-hour day.

10. No sweetening of time will be tolerated.

11. Only in extreme emergencies will members of crews be allowed to work more than 14 hours per 24-hour day. (For the first 24 hours or the first 36 hours the man in charge of the fire may be justified in working every man to the limit if by so doing he stands a good chance of bringing the fire under control and preventing further spread.) After this period, however, crews should be held down to 12 or at the most 14 hours a day.

12. Cooks, packers, truck drivers, clerks, etc., will be hired upon the day basis. No overtime will be allowed.

13. Crew bosses will be furnished by the timekeeper with a written list showing the number of men assigned to each crew boss and the identification number of each assigned man.

14. Crew bosses will take their men to the designated timekeeper for checking out before leaving camp and for checking upon the return to camp. Crew bosses will be held responsible for each of their men checking in and out, and upon return to camp will certify as to the hours of actual labor performed by each man of their crews. Timekeepers will see to it that crew bosses keep written records of time actually worked by each man on the line.

15. Timekeepers must be on the alert to check men in immediately as they enter camp. In order to insure promptness in this respect the timekeepers should post themselves so that they can readily intercept all men entering and leaving camp. Men leaving the line before the regular quitting time shall be given a written note by the crew boss for presentation to the timekeeper upon the man's return to camp. The note

shall show the hour of departure from the fire line. The crew boss will at the same time note upon his time record the hour of the man's departure. When the crew boss concerned returns to camp, the timekeeper will check such record with the crew boss to guard against any changing of hour by the individual, which might make for the sweetening of his time.

Unless instructed by authorized forest officers, timekeepers will not check out of camp fire fighters unaccompanied by crew bosses or other authorized bosses to report for duty on the fire line.

16. Laborers arriving at the fire camp who are clearly so physically deficient that the man in charge refuses to employ them should be allowed time and transportation as follows: This applies to boys, cripples, old men, etc., hired by the employment agency. To employ them is waste of money; to discharge them without time allowances and transportation is an injustice, since the employing agency is at least partially responsible for these predicaments. They will be allowed travel time under the instructions of paragraph 4 and will be furnished transportation back to their point of hire. In order to receive time and transportation under the instructions they must agree to be returned immediately.

17. Each item of commissary issued to an employee should be entered in the space provided on the reverse side of the time slip. Timekeepers are instructed to familiarize themselves with the detailed rules governing the issuance and accounting of commissary items.

OUTLINE OF DUTIES OF CAMP BOSS

1. Commissary duties.

a. Supervision of cooks and cookees.

b. Feed men on line.

c. Feed men at camp.

d. Transportation of grub:

To base camp.

Base camp to fire camp.

Fire camp to fire line and spike camps.

1. Commissary duties—Continued.

c. Purchase of grub:

Through dispatcher.

Direct purchase from nearest source.

f. Fuel and water.

g. Lights for night work.

2. Equipment.

a. Transportation from ranger station or cache to base camp.

b. Transportation from base camp to fire camp.

c. Care at fire and base camps:

Segregation according to kinds.

Reconditioning at camp.

Sharpening dull tools.

Rehandling.

Repair of spray pumps and lights.

Cleaning and filling of lights, kerosene and carbide.

d. Care of mess outfits.

3. Establishment and maintenance of camp.

a. Sleeping quarters.

b. Blankets or bed rolls.

c. Warming fires.

d. Lights.

e. Emergency kit.

f. Cook and mess tents or shacks.

4. Communication.

Communication must be maintained between the base camp and dispatcher's office; base camp and fire camp; fire camp and fire line. *Fire boss* is responsible for maintenance of communication from line to fire camp. *Camp boss* is responsible for maintenance of communications from fire camp to base camp and from base camp to dispatcher's office.

Means of communication:

a. *Messenger*—on foot, horseback, or in car.

b. Commercial lines.

c. Service lines.

d. Emergency wire.

Any or all of the above should be used to meet the situation.

All messages to the fire line, between camps and out to the nearest dispatcher will be in writing.

6. Demobilization duties.

Fire boss and camp boss must together plan demobilization.

Camp boss jobs:

a. Send out men culled by fire boss.

b. Send out equipment and grub not needed.

7. Office work after fire.

Submit memorandum of action and elapsed time report. With time keepers check time slips with fire boss or clerk. Submit other accounts.

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